MODERN PLASTICS

MAY 1959

Why polyethylene for better school furniture? *p. 90*

Exciting new RP molding technique: SPRAYUP *p. 85* | **What to watch for in blow molding** *p. 107*

Shift one of America's heaviest passenger cars into reverse—and this little ring transmits full engine power to the rear wheels! The ring is molded of Durez 16771 by Smithway Plastics, New Hudson, Mich.; Michigan Panelyte Division, St. Regis Paper Company, Dexter, Mich.; and Modern Plastics Corp., Benton Harbor, Mich.

New super-phenolic makes parts that can outwear metal!

Do you need *toughness,* along with all the other values a good plastic can give you?

Take a look at *Durez 16771,* the new super-phenolic that's reinforced with fibrous glass.

Engineers picked this material for the ring-shaped clutch cone in the automatic transmissions of three major automobiles.

When the transmission is shifted to reverse, this $3\frac{1}{2}$-ounce plastic cone transmits full engine power to move a $2\frac{3}{4}$-ton car!

Look what else this Durez phenolic does for the car manufacturers: it outlasts the material previously used . . . easily resists high transmission temperatures . . . remains dimensionally stable under all operating conditions . . . eliminates the tendency to gall, or roll up, which would cause reduced clearances.

In addition, it cuts manufacturing cost because hardly any finishing is needed. The part comes out of the mold, just as you see it here, to highly accurate tolerances.

Durez 16771 is formulated for high chemical resistance; withstands oil, water, mild acids and alkalies. Typical molded parts have an Izod impact strength up to 15 ft.-lb./in. It stands heat up to 600°F without distortion.

Your custom molder knows about *16771* and can help you put it to work. To explore how you can use it to get a better-functioning product, or reduce manufacturing costs, check with your molder now. Or, for more information, write for our *new Technical Bulletin on Durez 16771,* just off the press.

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Exhibiting a broad range of favorable physical and chemical properties, versatile CATALIN POLYETHYLENE sustains the same high standards of quality and purity set by Catalin Styrene and Nylon. Available in densities from .915 to .96, with melt indexes from 0.2 to 50, CATALIN POLYETHYLENE offers the widest spectrum of formulations, from which you can select the one that meets your manufacturing specifications exactly. Inquiries invited.

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MODERN

*

- **THE PLASTISCOPE**

New lightweight polyethylene foam material from Dow (p. 236); General Electric out of custom molding, Haveg takes over (p. 236); What Scripto is doing with plastics (p. 37); New look for U. S. pavilion in Moscow (p. 238).

- **EDITORIAL**

Union leaders are beginning to look for ways with which to instruct their members in the use of plastics. Here is what we can do to further a worthwhile movement.

- **GENERAL**

Intense interest is developing for this revolutionary reinforced plastics production technique. Some of the claims: labor costs cut up to 60%, glass waste reduction up to 25%, feasibility of thicker sections, and improved quality control. Several case histories spell out in detail how these savings were accomplished. The various sprayup systems—what they can do and how they differ from each other—are described.

One of America's major manufacturers of public seating has come out with high-density polyethylene seats and backs for its top-of-the-line school furniture, replacing earlier designs using plywood or reinforced plastics. Reasons behind this switch, expected markets, and production details are given. Our cover shows the seats in use. Color plates, Phillips Chemical Co.

At a fraction of the weight of traditionally fabricated coolers, new molded units bring increased insulation efficiency at considerably lower retail prices. Several companies have already switched from insulated metal containers to the new all-styrene type. Result: increased unit sales. Even refrigerated store cabinets are becoming a major market for this molded foam.

How molded nylon-reinforced phenolic pressure strips make possible double hung windows with removable sash and no counterweights is spelled out in this article. Development of the strip, which is of major significance to the home construction field, gives the producer several potent merchandising advantages.

What advantages can the furniture manufacturer derive from going to molded vinyl plastisol foam? Basically they are two: reduced raw materials cost and lower assembly charges. These savings are gained at no sacrifice in comfort factors, establishing for these new cushions a strong competitive position in the overall flexible foam market. Details of a typical production setup are traced step by step.

New material of construction, originally developed several years ago, now becomes economically feasible because of a nationwide system of distribution. Involved are concrete blocks to which polyester faces are molded. Initial cost of getting into production is less than $6000, compared with almost 10 times that much for earlier systems. Here is information on how the blocks are produced, how their cost compares with equivalent materials, and distribution.

When a natural gas utility company switched from a multi-unit assembly to a single fitting, it cut costs by more than 20 percent. This is a sizable market, with over 800,000 connections using this type of fitting annually.

Modern Plastics Executive and Editorial Offices: 575 Madison Avenue, New York 22, N. Y.
Please mail all correspondence, change of address notices, subscription orders, etc., to above address.

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PLASTICS*

MAY 1959
Volume 36 Number 9

Coming Up

June issue lead will tell about large polyolefin containers, how they are made (by molding, sintering, centrifugal casting, drape forming, welding), how they are being used, and where their future markets may be found. Some now in use have 1000-gallon capacity . . . In June also our third and final article on the urethanes, this one dealing with coatings and elastomers . . . Also an article on a new bowling alley designed for mass production in reinforced plastics . . . And an exciting story on the molding of vinyl shoes . . . Technical Section will feature a long-awaited article on isophthalic acid polyesters.

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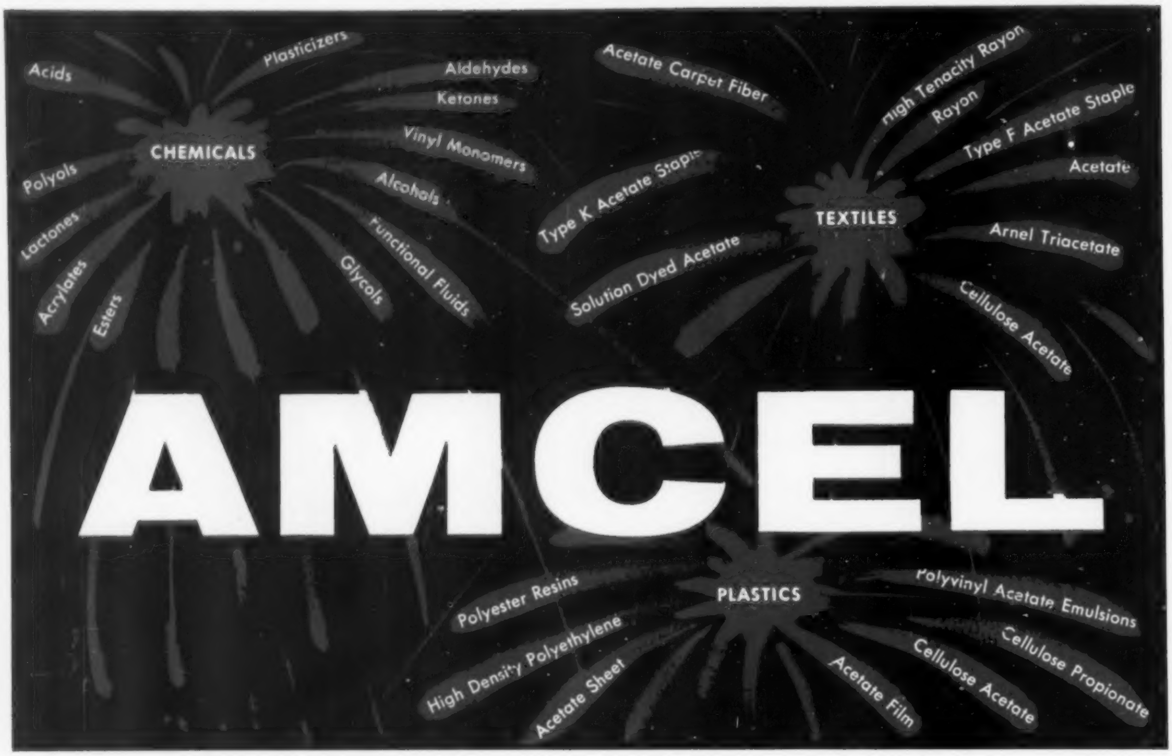

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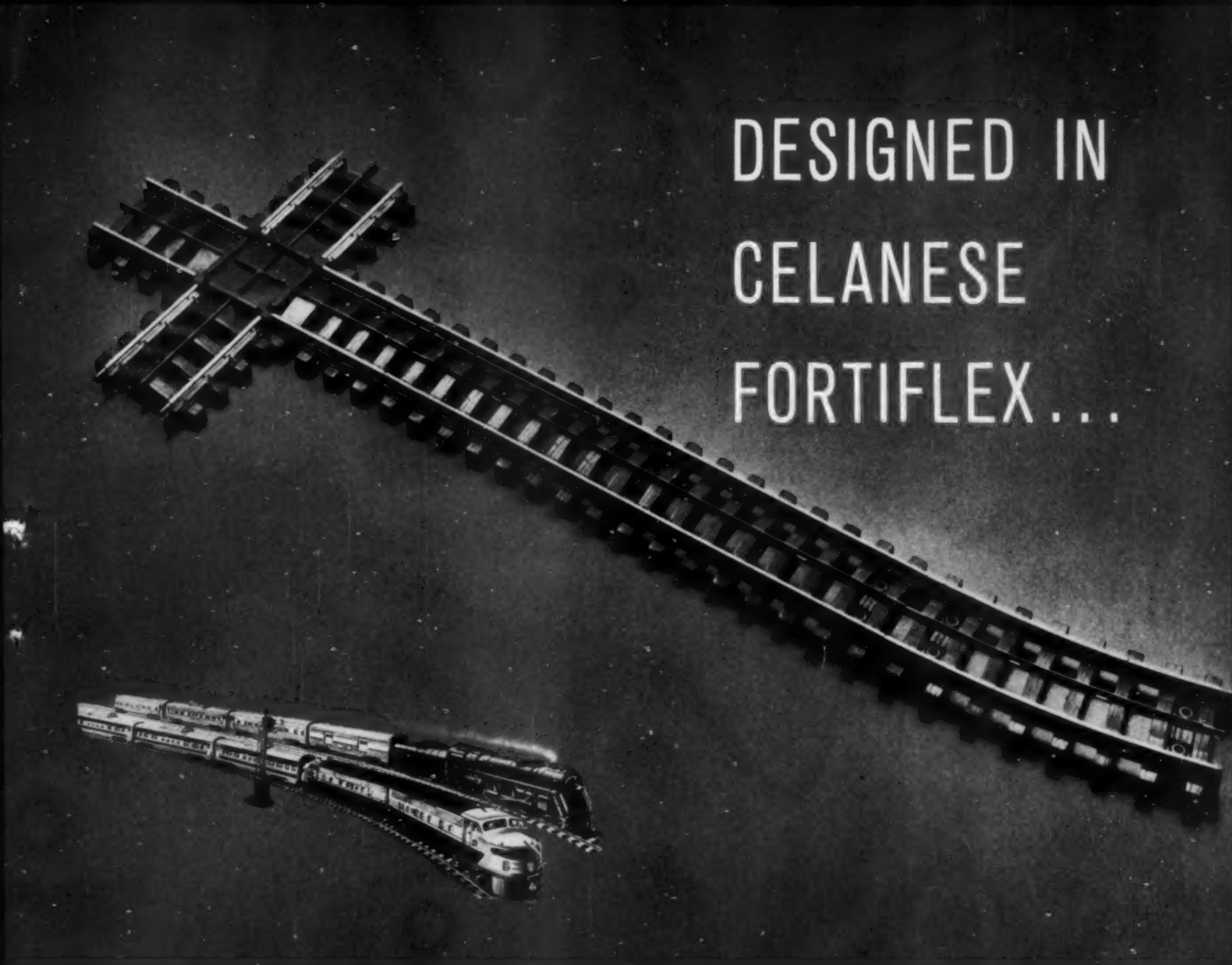

Lionel Model RR Track System looks like the real thing

Even the grain and the check marks of the ties are reproduced faithfully in this roadbed—injection molded in Fortiflex, the new Celanese linear polyolefin thermoplastic.

Although rigid and form retentive, Fortiflex contributes sound deadening properties that virtually eliminate the need for acoustical padding.

Fortiflex is now available in two types: A and B—in a number of melt indexes to meet the specifications of a variety of end use applications. For more information or test quantities, return coupon.

Celanese® Fortiflex®

TYPICAL PHYSICAL AND CHEMICAL PROPERTIES OF FORTIFLEX

Properties of Fortiflex "A" Related to Melt Index

PHYSICAL PROPERTIES	ASTM METHOD	UNITS	FORTIFLEX RESINS A-20	A-70	A-250	A-500
Melt Index	D-1238-52T	—	0.2	0.7	2.5	5.0
Heat Distortion Temp. (66 psi)	D-648-45T	°F.	185	185	180	180
Brittleness Temp.	D-764-52T	°F.	—200	—180	—160	—100
Impact Strength, izod (1/8" x 1/2" injection-molded bars)	D-256-54T	ft. lb./in. notch	23	18	13	3
Tensile Strength, Max., 0.2 in./min.	D-638-52T	psi.	3700	3600	3500	3300
Elongation, First Tensile Yield Point	D-638-52T	%	25	25	25	25

Properties of Fortiflex "A" Not Affected by Melt Index

PHYSICAL PROPERTIES	ASTM METHOD	UNITS	VALUE
Density		g/cc.	0.96
Refractive Index	D-542-50	n_D^{25}	1.54
Hardness, Shore D	D-676-49T		65
Stiffness	D-747-50	psi.	150,000
Water Absorption (1/8" specimen, 24 hr. immersion @ room temp.)	D-570-54T	%, wgt. gain	<0.01
Flammability	D-635-44	in./min.	1.0
*Mold Shrinkage, length		in./in.	0.03 to 0.05
width		in./in.	0.02 to 0.04

*Measured on injection molded tensile bar. Mold shrinkage depends on part design and molding conditions.

Celanese Corporation of America, Plastics Division,
Dept. 101-E, 744 Broad Street, Newark 2, N. J.

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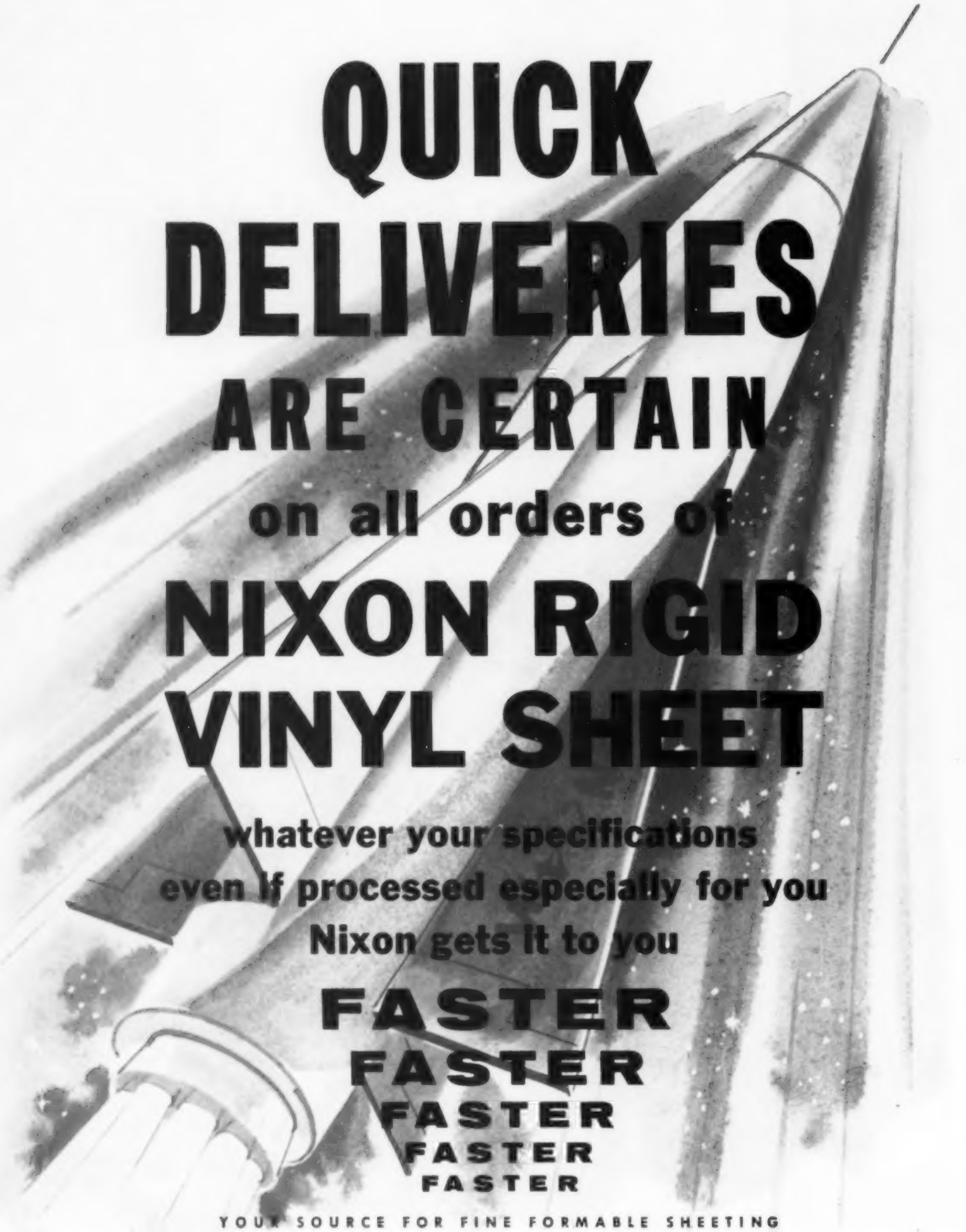

Photo courtesy General Electric Co., Bridgeport, Conn.

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But there's more here than meets the eye, for the product inside the container is a striking example of the extra advantages that PLIOVIC provides. In the case of PLIOVIC EDB90V – *an electrical grade resin* approved by the Underwriters' Laboratories, Inc. – you get a high-purity dry-blending PVC resin that flows freely, disperses readily–can be fed right into your extrusion equipment without Banbury fluxing or milling.

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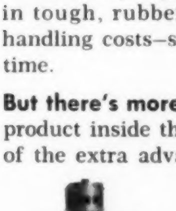

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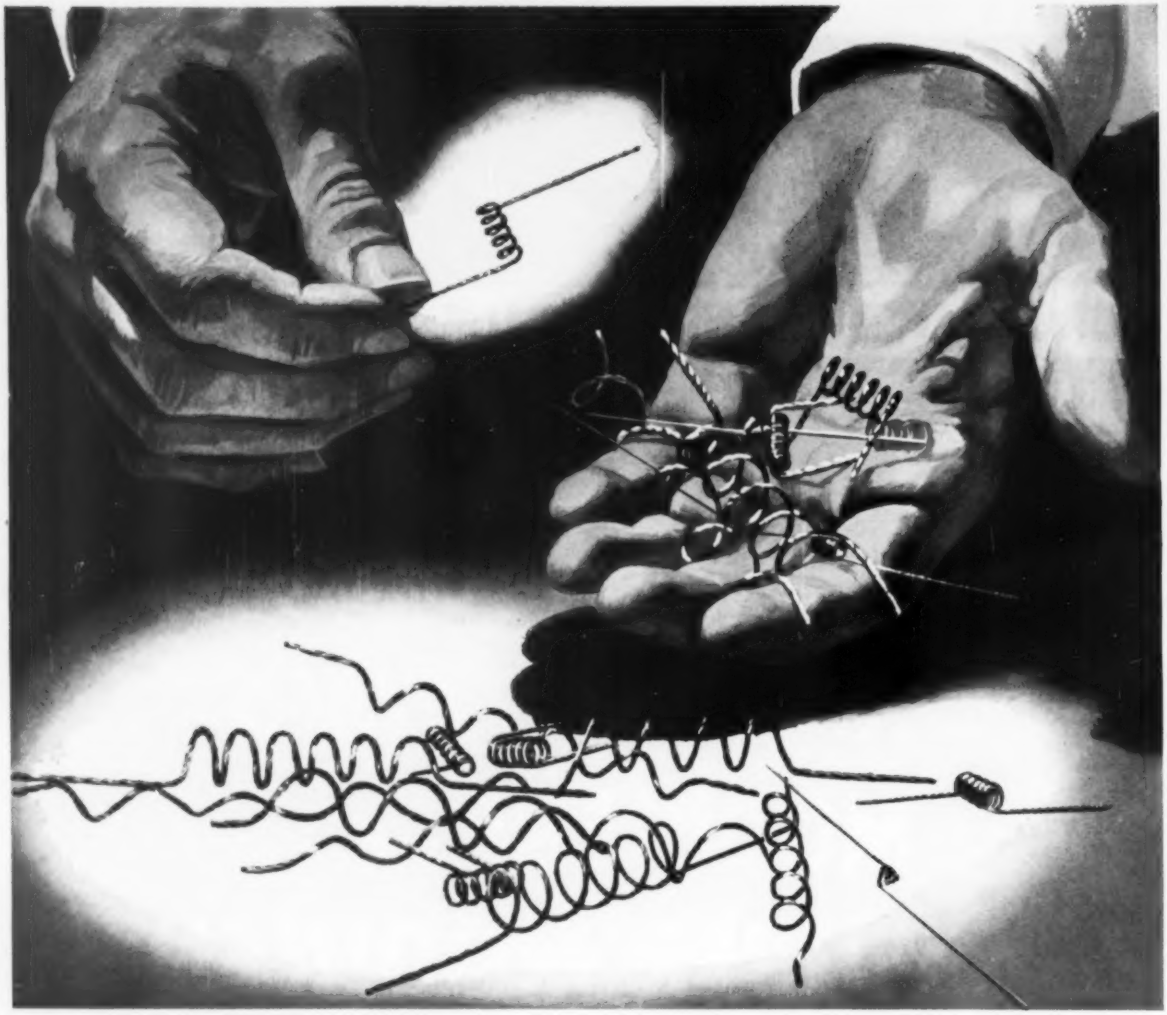

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U.S.I. POLYETHYLENE NEWS

A series for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

MAY, 1959 U.S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation 99 Park Ave., N. Y. 16, N. Y.

Packaging Notes

Easy opening feature for poly packaging is a "DACRON" cord set into the film. The feature is available for any type of polyethylene extrusion lamination, in both roll or pouch form. The cord can be imbedded in the surface of the poly coating, or placed between the poly coating and the material to which the polyethylene is applied. Pouches can also be fabricated with the cord sealed into the side seals of the pouch.

The cord feature is said to be especially suited to packages for cheese, meat, all kinds of dry products, cocoa powders, drink mixes and heat-in-the-pouch items.

Carrots are being marketed in full color, gravure printed poly bags. Appetizing illustrations appear on the face of the bags, along with smaller vignettes and recipes on the back. The bags are said to be the first in the produce field to be printed horizontally.

Universal polyethylene drum is designed to nest inside standard 15 gallon steel or fiber drums. The polyethylene container holds a full 15 gallons and is available with a variety of closures, from standard pipe or buttress threads to external cap closures.

The new drum nests and locks when stacked, needs no pallets. The poly drum is light in weight, unbreakable and carries low freight rates.

A dozen small pockets heat-sealed from a single sheet of polyethylene form a hanging point-of-purchase merchandiser for phonograph needles. The pockets, heat-sealed on three sides, are open at the top for easy removal of the packaged needles. The pocketed polyethylene sheet is stapled to a printed hang card. As the merchandise is sold, the pockets can be restocked. The display is especially suitable for small products that might otherwise be lost or subject to pilferage.

New packaging machine is said to be able to overwrap up to 75 boxes per minute with polyethylene. The machine can also feed, cut and seal a variety of packaging materials. It can handle units three to eight inches wide and a half inch high. Special machine design is necessary for five to nine inch widths. The machine accommodates packages 4¾ to 12½ inches long.

New U.S.I. Polyethylene Plant on Stream: Capacity 75,000,000 lbs. per Year

Plans Already Underway To Double Capacity

A second plant to produce U.S.I. PETROTHENE polyethylene has just gone on stream in Houston, Texas. Capacity of the plant — 75,000,000 pounds per year of low and intermediate density polyethylene resins — increases U.S.I.'s polyethylene production capacity to 175,000,000 pounds per year. The company's other plant, at Tuscola, Ill., now has a 100,000,000-pound-per-year capacity.

New Expansion Will Make U.S.I. 2nd Biggest Producer

When the current expansion program is completed late in 1960, U.S.I. will become the country's second largest producer of polyethylene resins. The new capacity will raise total production of PETROTHENE resins to 250 million pounds.

U.S.I.'s growth in the polyethylene field has been spectacular. Starting with a production capacity of 26 million pounds in 1955, the company will have realized a 900% increase in production when the expanded facilities go on stream.

Along with this growth has gone technical leadership in the field of polyethylene processing, particularly in packaging film. Recently, U.S.I. pioneered a new technique for producing crystal-clear cast poly film that is finding extensive application in large

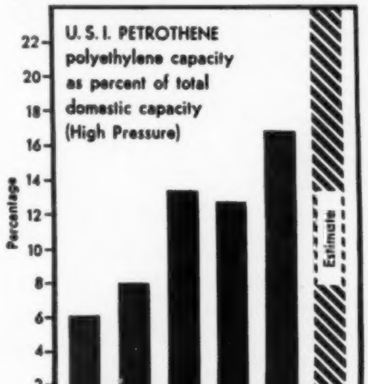

Chart shows spectacular growth of U.S.I. in polyethylene field. Starting as a non-producer less than four years ago, U.S.I. will produce almost one fourth of total U. S. high pressure polyethylene by 1960.

volume overwrap and bread wrap markets. While U.S.I. has specialized in low and medium density resins, it has done extensive research work on a new process for making high density polyethylene. The process is said to be superior to any now in use. U.S.I. also has studied the polypropylenes and other polyolefin copolymers in pilot plant operations.

Immediate Expansion planned

Along with the announcement that the plant was in operation, U.S.I. also made public plans to double the capacity of the plant by the end of 1960. This would bring the company's PETROTHENE production in the Houston area to a total of 150,000,000 pounds of polyethylene.

The location of the new plant is especially well suited for improved customer service. The Houston Ship Canal permits shipment by barge. All other means of transportation are readily available. Export shipments will be expedited through use of the extensive port facilities in Houston.

The staff for the Houston plant includes Byron J. Anderson, Plant Manager; Eugene C. Carlson, Technical Superintendent; T. Howard Dantzler, Superintendent of Operations; and E. P. Richards, Chief Engineer.

Wide Range of Resins Available

The new plant, which is already shipping commercial quantities, was rushed to completion some six to eight weeks ahead of schedule when demand for U.S.I. PETROTHENE resins began to outrun supply late in 1958. The plant uses a modification of the conventional high-pressure process already proved in the Tuscola plant. Low density (.915-.924) as well as intermediate density resins (.925-.929) are being produced. These are the polyethylene materials commonly marketed as packaging film, garment bags, squeeze bottles, wire and cable coatings and housewares.

In all, PETROTHENE polyethylenes are available in some 70 different resins, each varying in melt index, density, strength, clarity, gloss, slip, stiffness, and other properties. This wide range of resin properties is a result of U.S.I.'s program of tailor-making resins to meet specific molding and extrusion requirements.

DO YOU HAVE a new polyethylene packaging development you'd like the industry to know about? Make it routine to send your information on new developments to U.S.I. POLYETHYLENE NEWS.

Address the Editor,
U.S.I. POLYETHYLENE NEWS, U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corp., 99 Park Avenue, New York 16, N.Y.

Vol. IV, No. 3

U.S.I. POLYETHYLENE PROCESSING TIPS

FACTORS AFFECTING PERMEABILITY OF POLYETHYLENE

Polyethylene is highly impermeable to many liquids and gases. This property is one of the main reasons for polyethylene's widespread use in packaging.

In films and coatings, polyethylene is most often employed as a moisture barrier. It either protects materials from unwanted moisture or prevents loss of irreplaceable moisture from packaged products such as vegetables and meat. At the same time, some degree of permeability to oxygen and carbon dioxide allows leafy vegetables to "breathe."

As a liner for containers and in tubes and bottles, polyethylene's impermeability to numerous organic and inorganic chemicals accounts for its use with countless products – e.g., battery acid, brake fluid, acetone, ethyl alcohol, mustard, catsup, shampoos, detergents, hypochlorite bleach, and adhesives.

Continued development of new packaging applications depends on molders, extruders and manufacturers having a sound understanding of factors affecting the permeability of polyethylene.

Material To Be Packaged

Polyethylene's effectiveness as a barrier depends primarily on the material to be contained. As a broad generalization, the rule of "like permeates like" applies. Hence, polyethylene, a non-polar material, is only very slowly permeated by polar substances. As polarity decreases – and the contained substance more closely resembles polyethylene in structure – permeability increases.

Often not enough is known about the composition of a product to predict permeability behavior. Usually it is advisable to conduct tests, especially for doubtful materials. Cosmetics formulated with essential oils, for example, are frequently troublesome.

The vapor pressure of the contained fluid is important because the amount of a fluid or vapor passing through the barrier increases with its vapor pressure. Both vapor pressure and total gas pressure increase with temperature, so permeability tests of products such as aerosols should be run at the maximum storage temperature likely to be encountered.

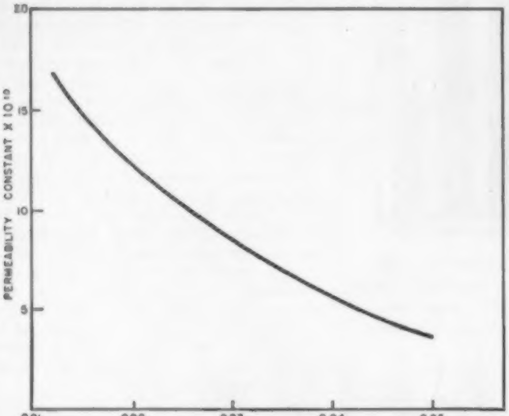

CHART I

Effect of polyethylene density on its permeability to nitrogen.

Effect of Polymer Density

Density is the basic property of polyethylene that affects permeability. As is shown for nitrogen in Chart I, permeability decreases with increase in polymer density. Increased crystallinity of the denser polymer is primarily responsible for this effect.

Effect of Processing Conditions

Permeability is affected adversely by improper processing conditions. Conditions causing non-uniform wall thickness or pinholes in the finished product naturally reduce the effectiveness of the barrier. Oxidation of polyethylene, generally brought about by subjecting it to excessive temperatures over prolonged periods of time, increases its permeability to polar compounds such as water and alcohols.

Pinholes are caused by moisture, resin degradation and air entrapment during fabrication. They can be minimized by keeping the molding powder dry and by holding extrusion temperatures within recommended limits. Often, difficulty with pinholes occurs in forming the parison in bottle blowing. Raising the temperature and increasing back pressure will frequently correct this condition.

Oxidation can be minimized by reducing extrusion temperature and by charging the machine with a special resin prior to shutdown. U.S.I.'s PETROTHENE® 205-1 Shutdown Resin, which withstands exposure at high temperatures, is recommended. Blanketing the hopper and die areas with an inert gas such as nitrogen also reduces oxidation. In blow molding, blowing with nitrogen has the same desirable effect.

Additives may modify polyethylene's permeability. Adding an inert material such as wax may enhance barrier properties provided the added material increases the density and doesn't destroy other essential properties. Other additives, such as aluminum powder, might decrease permeability by increasing the path that molecules of the contained material must traverse through the resin.

Postforming operations can also be useful. Coating with other polymers such as vinyls or vinylidene chloride offers one means of decreasing permeability. Irradiation, too, generally reduces permeability of all substances through polyethylene.

Technical Assistance from U.S.I.

Each polyethylene packaging application poses special permeability problems requiring a specific solution. The safest approach is to call on U.S.I.'s experienced technical service engineers. They can recommend an appropriate PETROTHENE polyethylene resin for your application and help you establish the best processing conditions.

U.S.INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corporation
99 Park Avenue, New York 16, N. Y.

IF PHENOLICS CAN DO IT

CAN PROVIDE IT...

already made or specially made

A world of application fitted to your product or production requirements is assured by Plenco phenolic molding compounds. These quality-tested and proven materials are readily obtainable in standard catagories, or can be custom designed to meet your most exacting special purpose.

We welcome every opportunity to demonstrate, as we have for many of the country's leading manufacturers and molders, our competence in connection with the supply of these materials.

You will find that Plenco's engineering and chemical research are continuing and positive factors in the development of improved compounds and new resins for the manufacturing of excellent products. You can benefit by consulting with us.

PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.

Sheboygan, Wisconsin

What looks like a snap Oft' ends in your lap

Oh, it looks easy enough.

Just hold up a stick, than add a glass and a saucer and a tray and a . . . oops!

Well, anyway, nothing broke because they were all made of plastics.

Plastics . . . juggling . . . they're really quite related, we've learned.

It's this way. Before we start on a molding job, we carefully determine from our customer what qualities and properties he wants his part or product to have.

Then we examine our available molding materials, *weighing* the specific gravities, tensile strengths, thermal conductivities, and so forth, of each one. And *balancing* the importance and need for each against the other.

This way, through 38 years of "performance," we've discovered how to give the customer what he wants.

Not that it hasn't taken some "fancy footwork" along the way.

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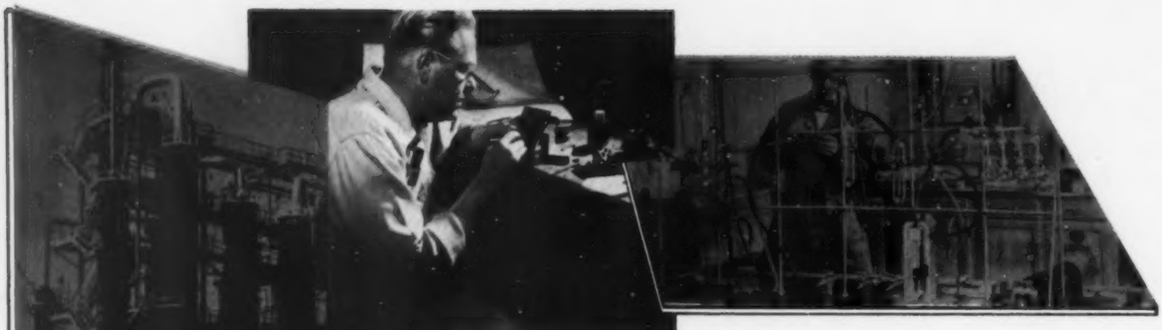
BOONTON, NEW JERSEY

New York Metropolitan Area—Cortlandt 7-0003
Western New York Area—Alden 7134
Connecticut Area—Woodbine 1-2109 (Tuckahoe, N. Y.)
Philadelphia Area—Pioneer 3-0315



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Foster Grant has the experience (40 years) and is fully equipped to give you unlimited assistance, in helping you to meet and solve difficult marketing, molding, machine design, and a number of other technical problems.

Only Foster Grant can offer you this wide range of customer services because the company is the only materials supplier with first hand experience in manufacturing and marketing plastic products.

This background of molding and marketing experience can be of invaluable assistance to you, for when you need it you can be sure you will receive —

1. **Unmatched service based on first hand knowledge of molder's problems.**
2. **Proven success in overcoming these problems.**

In any or all of the following areas listed below Foster Grant, with a staff of experts at your disposal, is eager to apply its 40 years of experience to the solution of your problems.

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Machine Design • Precise Color Matching

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NEW
16-ounce molding machine

Available in 3 new models,

the Farrel Watson-Stillman 16-ounce injection molding machine permits the choice of an injection rate that is ideally suited to the type of plastic to be molded. The three designs differ in injection-ram speeds, but are similar in other respects.

Hydraulically operated, the machine has manual and automatic single-cycle controls.

New bulletin 622-A gives complete details and specifications of this machine. Write for a copy today.

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WATSON-STILLMAN PRESS DIVISION
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WS-62

SPECIFICATIONS

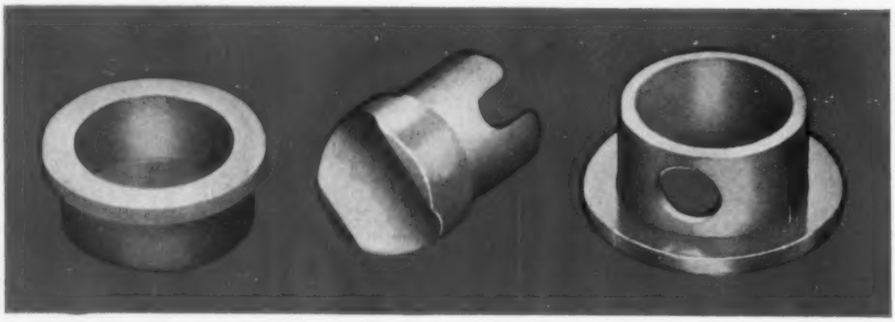
	16ES-400	16ES-400M	16ES-400S
Maximum amount of material per shot—Styrene	16	16	16
Injection rate (cubic inches per min.)	1,080	1,310	1,620
Daylight opening	34"	34"	34"
Maximum die sizes	20" x 36" and 21" x 33"		

Which injection rate is right for you?

FARREL WATSON STILLMAN ®

COMING SOON . . . SOMETHING NEW IN PREPLASTICIZING

In just 3 seconds, this Howmatic "12" Bench and Table folds away as shown at right! Made by Howe Folding Furniture, Inc., New York, N.Y., it uses 10 of the Spencer Nylon bearings pictured below. These bearings are fabricated by Springfield Moulders of Monson, Mass.



Another leading fabricator joins the . . .

Switch To Spencer Nylon For Close-Tolerance Molding:

A table with built-in benches that folds up into a single unit in just three seconds must have bearings that operate smoothly, absorb shocks without damage, and maintain close tolerances under rugged daily use.

The Howe Folding Furniture Company manufactures just such a bench and table unit. Springfield Moulders produces the bearings—and they recently switched to Spencer Nylon for use in this molding operation. There are a number of reasons:

(1) The special properties of Spencer Nylon make it easier to mold to close tolerances with fewer rejects. And these Spencer Nylon bearings maintain their close tolerances under tough treatment, because . . .

(2) Spencer Nylon absorbs shocks that would shatter many other plastics or badly damage metal. Also, the bearings of Spencer Nylon assure smooth, easy operation, month after month, since . . .

(3) Spencer Nylon is self lubricating. Unlike bearings made of ordinary materials, the Spencer Nylon bearings will *never* need lubrication.

If you have a problem-product, investigate the advantages offered by Spencer Nylon. You, too, may find that the special properties of one of Spencer's wide range of nylons offers a better solution to your materials problem.

For complete information, write to Spencer Chemical Company, Dwight Bldg., Kansas City 5, Mo.

SPENCER ®

SPENCER NYLON

SPENCER CHEMICAL COMPANY

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we'll make the press

YOU NAME THE MATERIAL CHARACTERISTICS

Just tell us the nature of the material—polyester, acrylic, fiber glass, rubber, or whatever—and give us your production specifications. We'll build the right compression molding press to meet your needs.

Erie Foundry regularly builds hydraulic molding presses in capacities of 25 to 4,000 tons. Our advanced design control systems will apply forces accurately and precisely, maintain platen temperatures within close tolerances, and perform molding cycles with split-second timing. Versatility is built in so that a wide range of molding jobs can be handled.

Write now for your copies of our descriptive bulletins on Erie Foundry hydraulic presses for rubber and plastics.

Hydraulic Press Division

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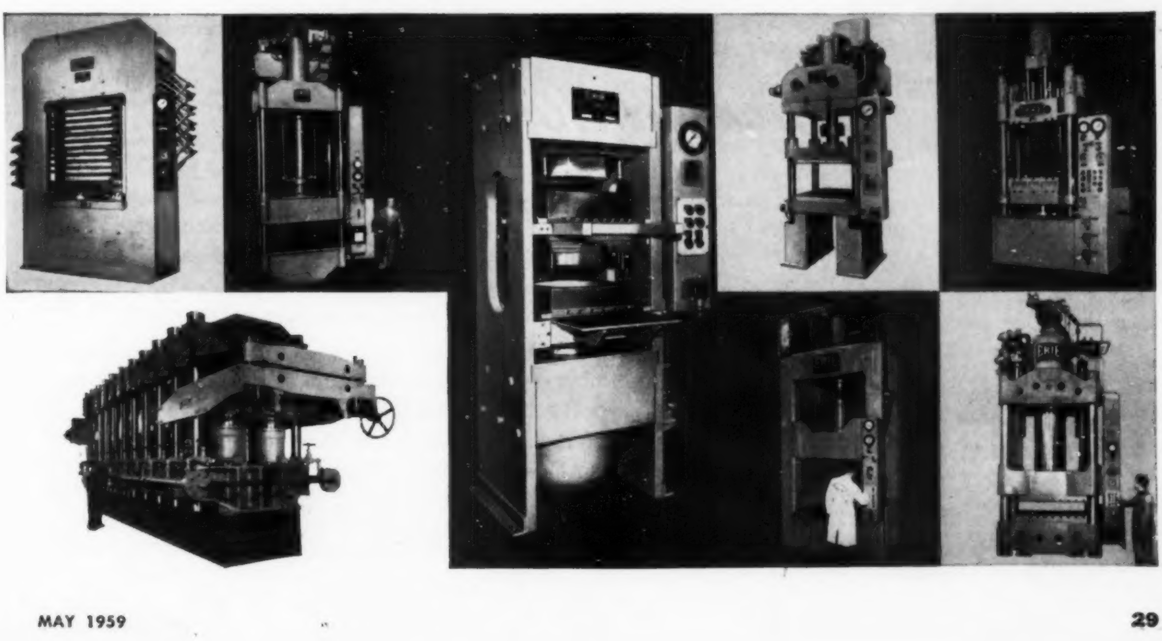


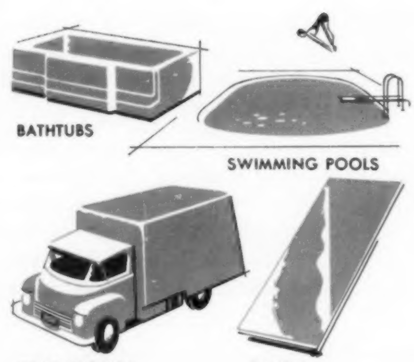
Hand layup fabricators of boats and other plastic products:

Cut material costs and production time with new GLIDPOL 1032 polyester resin system

Unique advantage of this rigid, medium viscosity resin is high thixotropy without affecting wetting out of glass fibers. It permits significant savings in amount of resin needed on vertical sections of layups. GLIDPOL 1032 stays put and wets out glass where other resins require flooding to complete wetting and avoid suckback.

Built-in accelerator develops cure rapidly after gelation. Reinforced plastic parts cure to handling hardness in less than an hour at room temperature, freeing molds for faster production.

Let Glidden demonstrate how you can cut costs and increase your profits. Write for complete information on GLIDPOL 1032 and other GLIDPOL polyester resin systems.



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Extrude highest quality, close-tolerance plastic pipe

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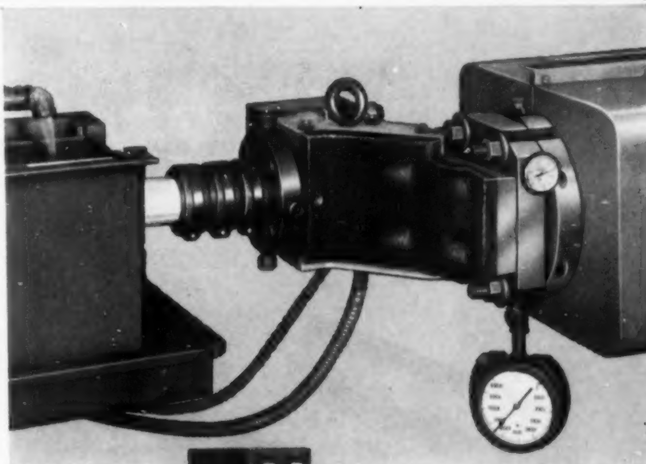
STREAMLINED—Minimum resistance to flow. New design eliminates "dead spots" . . . makes cleaning easy.

PRECISE DIMENSIONAL CONTROL—Built-in adjustable flow ring assures positive control of extrusion tolerances.

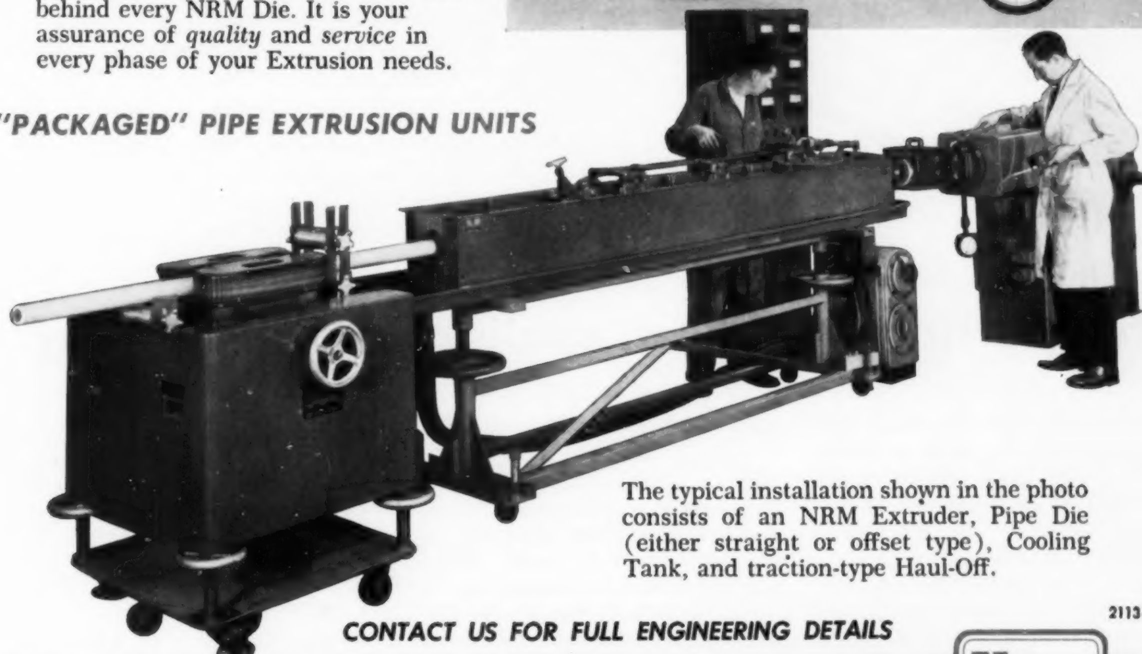
GREAT VERSATILITY—Die extrudes most thermoplastics . . . is available for the complete range of pipe sizes.

ACCESSORY—Dies are available with built-in valve for adjusting extrusion pressure.

When you are considering dies for your pipe extrusion setup, consider the long background of die engineering and manufacturing experience that stands behind every NRM Die. It is your assurance of *quality* and *service* in every phase of your Extrusion needs.



"PACKAGED" PIPE EXTRUSION UNITS



The typical installation shown in the photo consists of an NRM Extruder, Pipe Die (either straight or offset type), Cooling Tank, and traction-type Haul-Off.

2113-A

CONTACT US FOR FULL ENGINEERING DETAILS

NATIONAL RUBBER MACHINERY COMPANY

NRM

Creative Engineering

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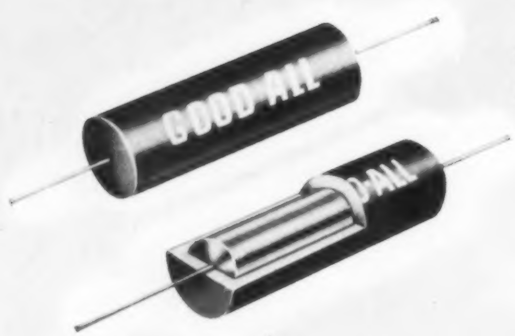
SOUTH: J. D. Robertson, Inc., Room 206, 3133 Maple Drive N.E., Atlanta 5, Ga.
WEST: Hans E. Buecken, P. O. Box 1357, Santa Barbara, Cal.
CANADIAN: F. F. Barber Machinery, Ltd., 187 Fleet St., West, Toronto, Ont.
EXPORT: Omni Products Corporation, 460 Fourth Ave., New York, N. Y.

Canadian General Electric Co., Ltd.

New streamlined transformers, molded in Epon resins, have superior insulation and dielectric strength. Accuracy and over-all performance are greatly improved.

Specify Epon® Resins...



Good-All Electric Manufacturing Co.

New Epon resin-molded 600 UE capacitors have superior moisture resistance. Offer rugged, trouble-free performance because Epon resin assures high dielectric strength, low leakage.

for potting, molding, sealing, encapsulating

SWITCH TO EPON resin-based compounds for potting, molding, sealing, and encapsulating to upgrade the performance of your electrical or electronic units . . . cut costs through design simplification.

Why? Because the excellent physical properties of Epon resins eliminate the need for conventional containers and housings. Size, weight, and complexity of components are reduced.

To lower costs and speed up production, manufacturers have moved in the direction of automation. In the new mixing, metering and dispensing equipment, even the most heavily filled Epon resin formulations can be used for high-volume, rapid-curing potting, encapsulating, and sealing operations.

Epon resins can be adapted to a wide variety of formulations designed to meet your specific needs. Write now for full information including a list of suppliers of Epon resin-based formulations and manufacturers of automatic mixing, metering, and dispensing equipment.

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THE PLASTISCOPE*

News and interpretations of the news

By R. L. Van Boskirk

Section 1 **May 1959**

Polyethylene coating resins. Industry seems more "hepped-up" about the future for PE coating resins today than about any other branch of the polyolefin field. Estimates of 100 or 150 million lb. annually within the next few years are bandied about without even an eyebrow flutter, despite an estimated consumption of only 40 million lb. in 1958.

Du Pont's implied faith in the future of PE coating resins is demonstrated by introduction of their new Alathon 15 for use where ultra-thin coatings are required on paper, foil, or fabric to resist punctures, moisture, or abrasion. This is the third Du Pont resin designed primarily for coating.

Alathon 15 offers improved neckdown characteristics. Neckdown is the tendency of a coating to thicken along the edges. This thickening must generally be trimmed away. With "15" this tendency is overcome, permitting extrusion of extremely wide widths. The new resin also permits lower heat-sealing temperatures when it is used on saran-coated cellophane, eliminating softening, bubbling, or delamination of the more heat-sensitive polymer on the base coat. The density is 0.917 and MI is 4.

Other coating resins. Du Pont's other coating materials are Alathon 16 and 34. The first, with a density of 0.923 and an MI of 3.7, offers protection against transmission of water vapor. Alathon 34 is preferred where maximum moisture and grease resistance are required. Density is 0.930 and MI is 3.

The reader will note that, in general, as density becomes higher there is less permeability to gases, oils, etc., and temperature and grease resistance are improved. As density goes down, there is less neckdown, better adhesion, and lower sealing temperatures. As melt index gets higher the coating can be decreased in thickness, adhesion is better, and lower seal temperatures are possible. As MI decreases, there is less neckdown. From the above it is obvious that the user needs a variety of coating resins in order to choose the one most applicable to his purpose; and Du Pont aims to supply that variety.

Vinyl chloride flexible magnets. RCA Whirlpool is now conducting a vast advertising campaign for a new refrigerator that features "new magnetic door gaskets consisting of a million magnets that form a positive seal all around both doors." The seal is made by a strip of magnetized vinyl chloride extruded by B. F. Goodrich Industrial Products. The magnetic strip is used inside a flexible gasket to form an airtight seal around the entire perimeter of the refrigerator door and eliminates the need for a latch. It can be produced in continuous lengths in an unlimited number of shapes ranging in size from spaghetti to garden hose, and can be cut without impairing its magnetic qualities.

Other suggested uses are for auto glove compartments, handbags, compacts, toys, calendars, bulletin boards that can be affixed to (To page 37)

*Reg. U.S. Pat. Off.

THE PLASTISCOPE

(Continued from page 35)

metal partitions, briefcase closures, condiment shelves to prevent tipping of metal boxes, etc. The company is now producing well over 10 miles a week of this unusual material.

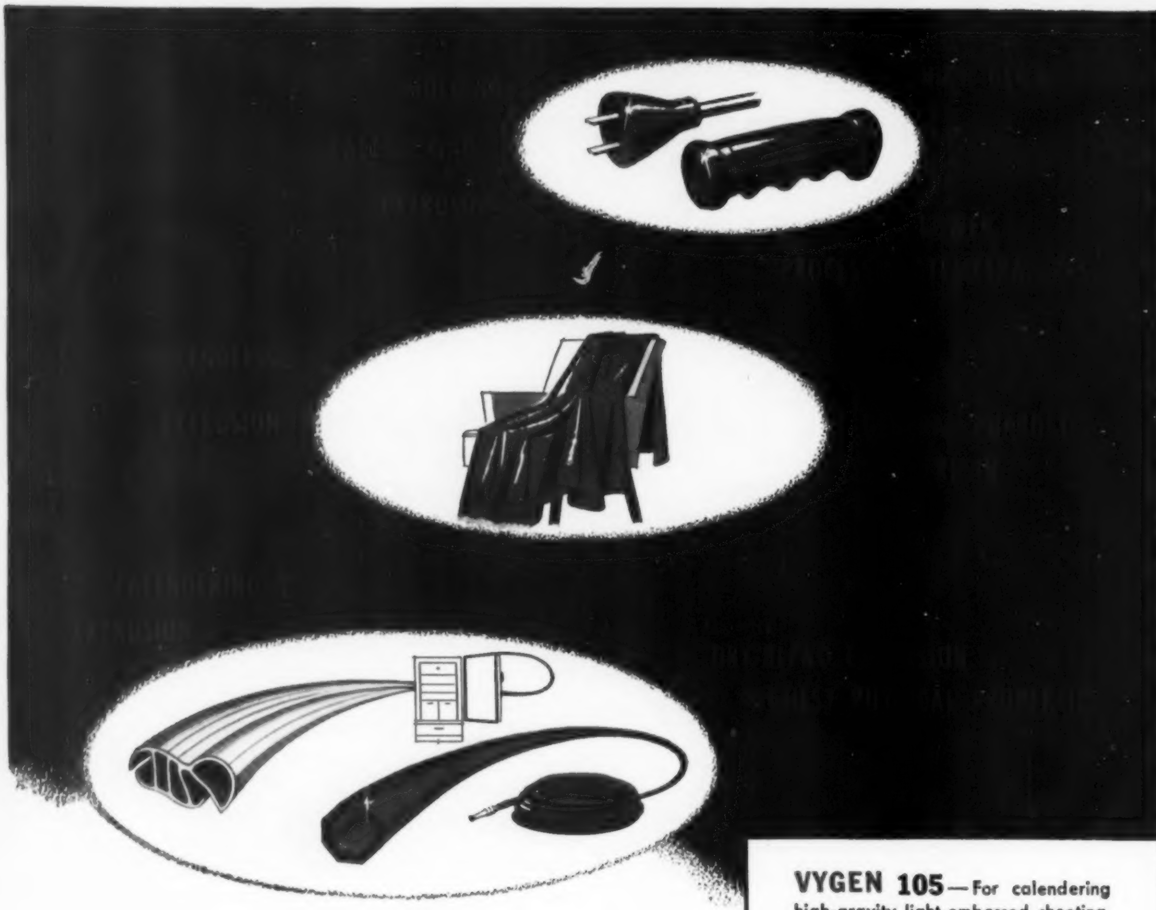
Plastics in pencils. A sales gain of from $3 million in 1947 to $23 million in 1958 on basically a 29¢ item is the remarkable record achieved by Scripto, mechanical pen and pencil manufacturer, Atlanta, Ga. At the company's plant, some 20 injection machines, ranging in size from 3 to 16 oz., work around the clock, three or four of them on nylon.

The latest item is a stylish, new concept in ball point pen design by Walter Darwin Teague. It sells for a dollar. The barrel is cellulose propionate with a brilliant lustre finish, and there are several small nylon working parts.

The company has long been known to the trade as a customer that buys first quality goods and among the first to try out new materials. Scripto started injection molding on an imported German Isoma machine in 1936 and has been using molded plastics pencil barrels exclusively for many years. The company buys the highest heat-resistant polystyrene available (because of the sun-heat generated in store windows where the pencils are on display), colored by the resin producer. It was one of the first to use polypropylene—the application is an extruded cartridge ink container which has superseded polyethylene in the less-than-dollar range ball pens. Company technicians became expert molders of nylon when few knew how to handle it; they have been experimenting for some time with Dow's styrene-methacrylate copolymer; they are designing special mechanical parts of Delrin to replace cast metal; and they are molding stylus-type ball point pens of rigid vinyl chloride because of that resin's resistance to all types of ink.

Incidentally, the total pen and pencil business in the U. S. is no pigmy. There are some 800 million ball point pens produced annually, and the barrels alone average from 10 to 12 lb./1000 units. The plastics involved are primarily butyrate and propionate, but nitrate, nylon, ABS, and others are also involved. Another interesting point is that wooden pencils continue to increase annually with the latest figure set at 1.5 billion—and use 646,000 gallons of nitrocellulose lacquer.

New vinyl copolymer solution applications. Borden Chemical is marketing a new group of copolymer resins for solution applications that are used primarily in top coatings for vinyl coated fabric, paper coatings, and aluminum. Designated VC-155, -158, -170 and -175, the resins are asserted to be quite different from any other copolymer resin of the type used for solution coatings. VC-158, -170, and -175 offer a variety of types to the coater depending upon his need. The higher the number of the resin the less tendency that resin will have to block in high temperature uses, but the solids content declines as the number of the resin goes up. Thus 175 is less inclined to block, but 158 has a greater solids content. Processors who depend on the vinyl resin used in the basic coating job for non-blocking are more prone to sacrifice solids content in the top coating resin. Thus Borden offers the choice of an ultimate in non-blocking, a high solids resin or a medium choice, or the **(To page 39)**



THE PLASTISCOPE

(Continued from page 37)

processor may blend depending on the thickness of the film or the solids concentration he desires. VC-155, the fourth of these resins, is used primarily for paper coating, but can be blended with the others if higher solids are wanted.

Plastics affected by new food law? The new Food Additives Amendment to the Federal Food, Drug and Cosmetic Act (the Williams Law) is of vital interest to the plastics industry. It bans the use of untested additives in food with an additive defined as any substance that may affect food—thus the package is included because it contains material that could possibly migrate into food. Inks, adhesives, and tapes are all included. The packager is responsible for testing and must get clearance from F&DA before marketing his product. The law may even affect such things as certain types of coated cellophane that have been on the market a long time. An interpretation of the law and how it may be applied is given in detail in the May issue of *Modern Packaging.*

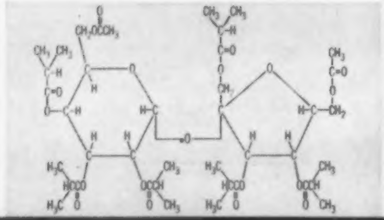
Semi-conductor in plastics. Abbey Plastics Corp., Hudson, Mass., has developed a polyvinyl chloride compound from Monsanto's Opalon vinyl that is described as a "semi-conductor" of electrical current. It does *not* carry current but acts something like the metallic shields that are used around high frequency equipment. It could be used, for example, on gasketing to help avoid static sparks. A promising application is replacement for copper braid shielding on microphone cable. Its action may be likened to a sponge. It doesn't carry water as well as pipe, but the water can still be pushed through, although the sponge offers some resistance. In this case the vinyl offers some resistance to an electrical current and thus can be used for shielding and grounding.

Exports in 1958. Almost 242 million lb. of polyethylene resin and semi-finished forms, except film and laminates, were exported from the United States in 1958, according to the Census Bureau's final capitulation. Total sales of all polyethylene resin in the U. S., including the above figure was about 840 million pounds. Almost 10 million lb. of film (not included above) were exported, with between 6 and 7 million for the Latin American banana countries. The total export figure for resin in 1957 was 192 million pounds. Largest importers of PE were Canada, Japan, and Belgium.

Uncompounded vinyl chloride resin export was 21 million, compared with 30 million lb. in 1957. Compounded vinyl export amounted to 21 million in 1958 and 15 million in 1957. Principal importers of uncompounded resin were Canada, United Kingdom, West Germany, and Australia.

Polystyrene exports had a big growth—from 63 million in '57 to almost 90 million in 1958. Japan (13.2 million), West Germany (11.7 million), and Canada (10.4 million) were the largest customers for styrene materials.

Fluorination of polyethylene containers. Plax Corp. has purchased exclusive rights from Shulton, Inc. for fluorination of polyethylene and other thermoplastics to reduce their permeability. Considerable further research is required to make the process commercial. **(To page 41)**



STRUCTURE FORMULA APPEARANCE

SUCROSE ACETATE ISOBUTYRATE

New Resin Modifier-Extender
produces non-fuming hot melts
extends peelable plastic coatings
improves extrusion and molding properties

Here is a new compound that warrants your investigation for its unusual physical properties.

Sucrose Acetate IsoButyrate (SAIB) is a clear, colorless semi-solid with outstanding stability to heat aging *(See Figure 1)*, ultraviolet light and hydrolysis. Less than 0.2% is hydrolyzed after refluxing in water for 4 days.

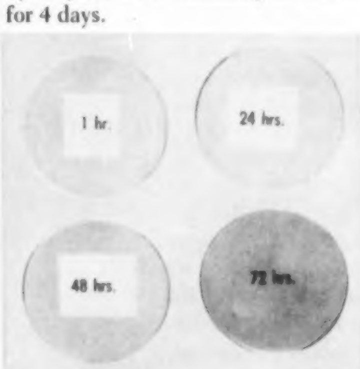


FIGURE 1. *Test specimens containing 70% SAIB, 20% cellulose acetate butyrate and 5% NP-10 plasticizer after exposure to 350°F illustrate excellent heat stability of new modifier-extender.*

It is extremely viscous at room temperature yet very sensitive to temperature change. At room temperature, the viscosity of SAIB is approximately 100,000 centipoises. Heating it to 100°C causes the viscosity to drop to only 90 centipoises.

It is compatible with nearly all polymers and modifiers and is highly soluble in most common solvents. A 90% solution of SAIB in ethyl alcohol, for example, has a viscosity of only 750 centipoises at 30°C.

With its excellent permanence, compatibility and solubility characteristics, it is little wonder SAIB is useful in hot melt and peelable plastic formulations.

Tough, flexible melt coatings can be made containing up to 70% SAIB. They have good adhesion to paper and are not tacky. One of their outstanding features is a complete absence of fuming at melt temperatures.

Modification with SAIB also lowers the operating temperature of hot melts. For example, the usual application temperature for conventional butyrate hot melts is 350°F. With high SAIB modification, the optimum temperature is down around 275°F.

In ethyl cellulose hot melt compositions, SAIB acts as a solubilizer for the mineral oil, reducing exudation of the oil from the film and enabling the formulator to use increased amounts of oil. *(See Figure 2)*

Use of SAIB in peelable coatings improves their resistance to exudation, thus prolonging their flexibility.

Recent studies show the use of SAIB with plasticizers improves their permanence along with the extrusion and molding properties of the plastics in which they are used, such as those based on cellulose acetate.

FIGURE 2. *Melt coating composition containing 70% SAIB shows no exudation after 8 months' aging at room temperature.*

SAIB is available in both a 90% strength in ethyl alcohol solution, designated *SAIB-90* and a 100% concentrate, designated simply *SAIB*.

Many more applications for this unique plasticizer-resin are being investigated by the Eastman Customer Service Laboratories. Some of the results of these studies are reported in a booklet available for the asking. To get your copy or a sample of SAIB, or both, write to Chemical Sales Development Department, Chemicals Division, Eastman Chemical Products, Inc., Kingsport, Tennessee.

SAIB

SUCROSE ACETATE ISOBUTYRATE

Eastman CHEMICAL PRODUCTS, INC., KINGSPORT, TENNESSEE, subsidiary of Eastman Kodak Company

THE PLASTISCOPE

(Continued from page 39)

Plax does not say how PE bottles are exposed to fluorine gas, but it is known to be a dangerous, critical operation that requires extreme skill in handling, since fluorine is one of the most active and toxic gases known. It is not expected that fluorinated bottles would greatly improve the imperviousness of PE over the currently used vinyl liners now employed by Plax, but it is possible that when bottle production gets into the big volume predicted for it in the future, the fluorinating process may be more economical.

Delrin on display. Du Pont's new Delrin acetal resin, which is featured in the company's television program for May, is pictured as a 3-in. drawbar subjected to the pull of a 16-ton tractor. A force great enough to move a dead weight of 15 tons failed to rupture the Delrin drawbar.

Delrin will be commercially available this summer. It will sell for 95¢/lb., which makes it comparable to nylon at $1.18 because of a difference in specific gravity. However, Delrin is produced from a low cost-raw material, formaldehyde, and is expected to be sold at a much lower price when large scale use is developed. Over 250 companies have been working with it in experimental lots the past three years, and will no doubt have applications ready to mold or extrude when it becomes commercially available. At the recent Packaging Show it was promoted particularly as a material for aerosol containers and closures.

Delrin is a linear polymer with unbranched chains that form dense crystals, which differ from those of other plastics and put it in middle ground between plastics and metals. It is extremely rigid without being brittle—is both tough and resilient—and retains these properties under adverse conditions of temperature and humidity and during exposure to most solvents.

Improved resin for cable jacketing. A new polyethylene cable jacketing resin which is claimed to be particularly resistant to stress-cracking has been announced by Spencer Chemical Co. It is designated as Poly-Eth 3812 (formerly TD494). The new black compound is based on a 0.918-density material of high molecular weight, and is claimed to have been produced by a new polymerization process.

Polyethylene milk case. A case for carrying paper milk containers, said to be stronger at half the weight of conventional cases, has been introduced by the Product Development Dept., St. Regis Paper Co. The case is molded of Phillips' Marlex linear polyethylene at St. Regis' Cambridge, Ohio plant. The case, which holds nine half-gallon or 16 quart containers, incorporates a resilience which provides a cushion for the paper containers and curbs the number of leakers caused by impact damage. It can withstand steam cleaning in caustic or acid solutions and will not rust. It retains its strength and shape in temperatures ranging from −180° to 250°F.

For additional and more detailed news see Section 2, starting on p. 236

LETTERS TO MODERN PLASTICS

Where readers may voice their opinions on any phase of the plastics industries. The editors take no responsibility for opinions expressed.

Copper in acrylic? Easy

In the *Modern Plastics Encyclopedia Issue for 1959* there is an article on page 833 relating to the embedding of copper in acrylics. It states that copper acts as an inhibitor and that it prevents proper polymerization.

I have been doing embedding work for quite a few years, and have mounted a considerable amount of virgin copper ore, right from the mines in Utah, and have not had any trouble in doing so.

Also on page 835 reference is made to factory monomer with an inhibitor remaining fluid only several months, unless refrigerated. I have about 15 gallons left of Plexiglas monomer which I bought in 1945. The shipping tags are still on the crates. This monomer is still fluid, and never was under refrigeration.

W. A. Sampsel
Acrylic Plastic Laboratory
Culver City, Calif.

Are exhibits the answer?

Your editorial in the March issue "Too many papers" is equally pertinent in numerous fields in which science and technology work so closely on behalf of industry.

One way in which some reduction in paper presentation can be effected at conferences (a reduction where it is most needed, in the area of the scientific-commercial message), is through improved use of exhibits.

Exhibits are the least effectively used media of communication, yet they cost their producers a lot of money for space, construction, shipping, staffing and storage. But how many attempt to say anything significant at a conference?

The fault lies all along the line. Top brass demands too little of the exhibit medium. The exhibit officer of a company or institution is too often more interested in exhibit mechanics than in scientific or technical communication; and the same group that designs and builds an exhibit for the merchandising of auto parts is expected to turn out an effective show on platinum-based catalysts or the volatility of plasticizers. Because they are expected to do this we see a plethora of shows that resort to arty symbolism instead of factual presentation.

Nobody asks the ad man to prepare technical papers, nor is the use of reports abandoned just because ad men can't prepare them. The scientist or technical writer, or editor, does the job. So it can be with exhibits. Demand more of the medium. Use it for serious communication, and require that it be used to secure predetermined results. When this is done the Association Executive will know that exhibits are more than a money-making device for the association and the exhibitor will know that his investment is doing a more effective job for the investor and for his audience.

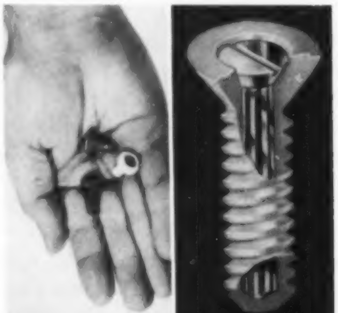
All the facilities exist. Only a firm demand is lacking.

Leonard C. Rennie, Pres.
Design and Production, Inc.
Alexandria, Va.

Member of the wedding

We read with great interest your commentaries in the Plastiscope of March 1959.

Of especial interest was the paragraph titled "Another wedding in the plastics industry" and the statement, "Many experts have testified that when plastics became married to other materials volume use would increase in unpredictable quantity." This is also our belief and our feel-



ing and is carried out with our new fastener concept known as Insul-Screw which was formally introduced in February 1959.

This product is a composite plastic-and-metal screw consisting of a serrated metal core with a molded nylon exterior. The core, relative to the nylon, is completely immobilized and the two materials blend their properties to perform as an integral fastening unit. The point of this design is that the metal core provides metal-to-metal driving contact, and torque and shear strength; while the nylon exterior contributes self-sealing, chemical inertness, color, and shock absorption.

The advent of U. S. Steel into the field of plastisol-steel should indeed be of great import to all of us in the plastics industry.

Sid Schyman
Austin Screw Products Co.
Chicago, Ill.

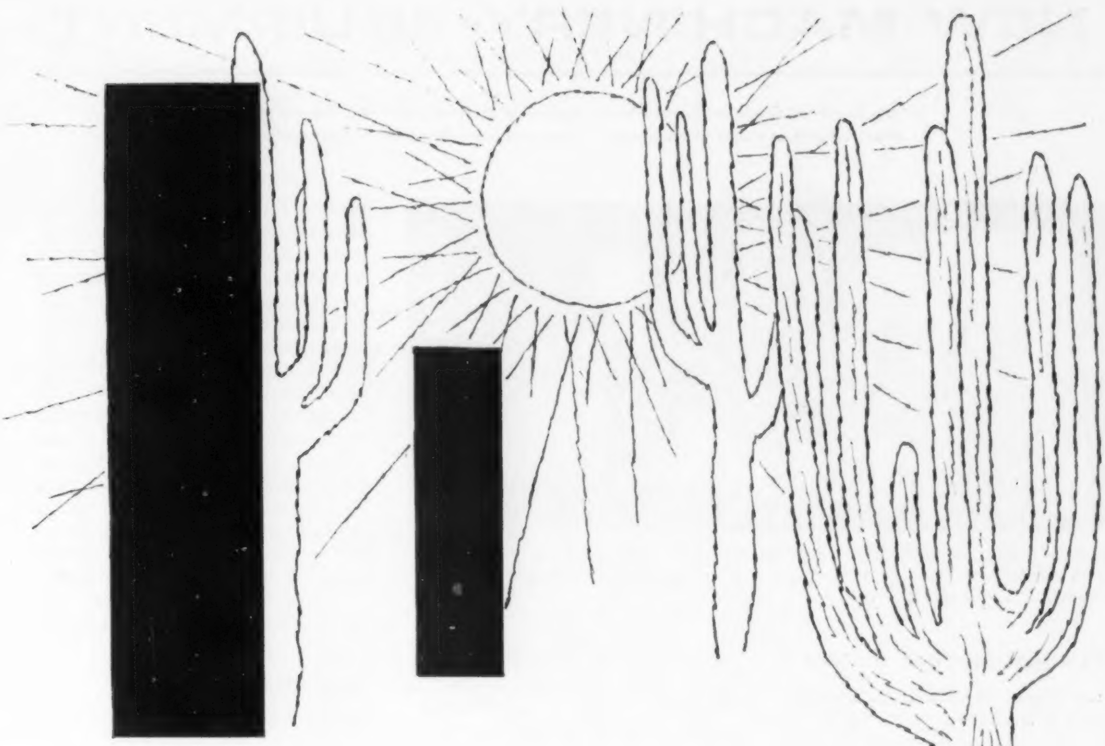
News from India

According to our present planning, I shall be leaving India some time by the end of May 1959 as a leader of the Productivity Team for Plastics Industry, and visit Japan first where we shall spend about 10 days. We will then fly from Japan to America, and expect to spend about three weeks there.

We are now busy in preparing our Third Five-Year Plan for Plastics Industry, and now that the country is completely self-supporting so far as the manufactured goods are concerned, we are taking all steps to develop raw material manufacturing. In this direction also, we are now already manufacturing phenol-formaldehyde moulding powder, urea formaldehyde moulding powder, and polystyrene. There are two projects —one by I.C.I. and the other by National Carbon Co. (Union Carbide)—to manufacture polyethylene in India. I.C.I. will start production in the course of the next two or three months, and the National Carbon will follow suit. There is also a project going ahead very satisfactorily for the manufacture of PVC in this country, and by the end of 1959, we shall be manufacturing about 25 million pounds of raw material, and by 1960 about 30 million pounds.

We are now busily engaged in studying the possibilities of manufacturing machinery in this country. We are hoping against hopes that we shall be able to implement this step before the close of this year. Of course, a small and modest beginning has already been made.

B. D. Garware
Chowpatty Chambers, Sandhurst Bridge, Bombay 7, India.—**End**



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For full information, call your Du Pont Pigments Representative, or write: E. I. du Pont de Nemours & Co. (Inc.), Pigments Dept., Wilmington 98, Delaware. In Canada: Du Pont of Canada Limited, P. O. Box 660, Montreal, Quebec.

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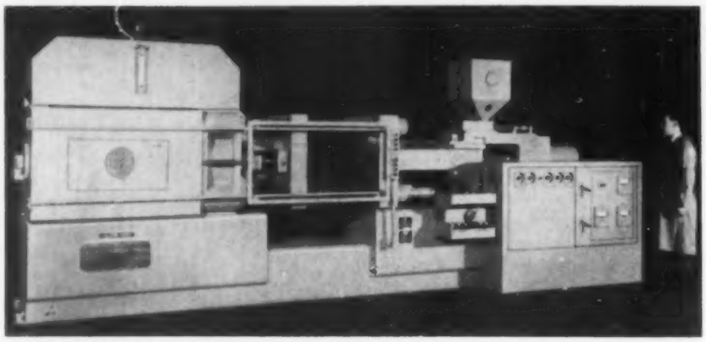
NEW MACHINERY-EQUIPMENT

Specifications, claims made, and prices appearing in these pages are those of the manufacturers or sellers of the machinery and equipment described, or their agents.*



H-P-M Model 350-HV-12/16 injection machine dry-cycles in 6 sec. with full clamping-stroke and tonnage; is claimed to be fastest machine available in that size class.

12/16-oz. injection machine

The Model 350-HV-12/16 injection molder is claimed to be the fastest machine available in that size class. Dry-cycle time is 6 sec. with full clamping stroke and tonnage, even less with reduced stroke. Stroke is up to 22 in., tonnage 350, daylight (with ejector box) is 34 inches. Mold bases up to 34 by 20 in. may be accommodated, either vertically or horizontally. Knockout bar has 4-in. stroke, 20-ton force, is easily positioned for vertical or horizontal knockout pattern. The clamp automatically adjusts for different mold thicknesses, thus helping to reduce setting-up time. Independent clamping and injection circuits permit simultaneous traversing of both rams, cuts dead time. Injection features include prepacking, low holding pressure, plunger prepositioning, clamp-pressure actuation. All controls are out in the open, easily accessible. *The Hydraulic Press Mfg. Co., Mount Gilead, Ohio.*

Vacuum drier for plastics

A complete drying system for heat-sensitive materials is based on drying under vacuum at relatively low temperature. The actual vacuum chamber, with shelves, comes in a number of standard sizes from 2 sq. ft. to 846 sq. ft. effective pan surface, and can be special-ordered to fit user's needs. Chamber is jacketed for hot-water heating, electrical hot-water system is included, and there is a control panel. Powder to be dried is placed in pans 1 to 1.5 in. deep. Typical performance: Zytel 31 containing 3% moisture can be dried to molding dryness in 4 to 6 hours. *J. P. Devine Mfg. Co., 101 49th Street, Pittsburgh 1, Pa.*

Rotary laminating presses

These presses are designed to apply pressure in laminating various sheet materials with pressure-sensitive adhesives. They consist essentially of a pair of equal-diameter, power-driven rolls between which the laminate is passed to form a strong bond under line contact. Rolls come in widths up to 122 in., in diameters ranging from 6.5 to 8.8 in., and may be rubber covered, ground steel, or plated. Rubber is Neoprene of 60 to 70 Durometer A hardness. Daylight opening may be adjusted from 0 to 4.5 inches. Pressing force, applied by weight of top roll plus springs or air cylinders, may be as high as 7700 pounds. Laminate advance rate, with optional variable-speed drive, ranges from 10 to 60 ft./min. Other options include a patented safety control, a thickness-adjustment dial indicator, and guiding rolls. *The Black Brothers Co., Inc., Mendota, Ill.*

Strip-stock feeders

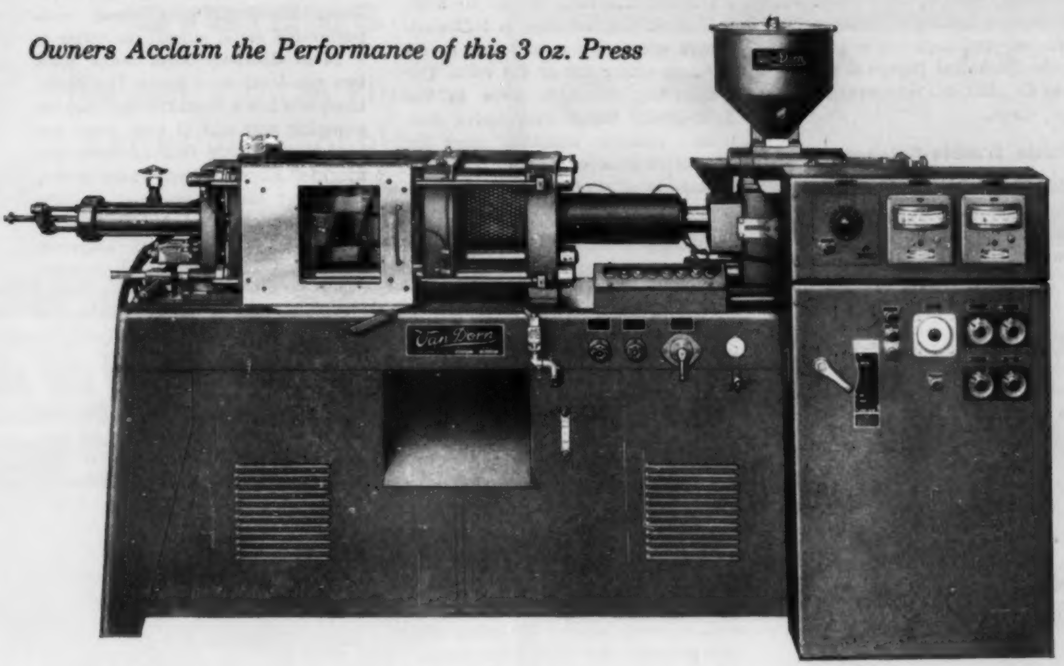
Punchers and blankers of laminates are offered a new series of automatic strip-stock feeders that are claimed to have saved up to 80% in production costs. The feeders attach directly to the bolster plate of any standard blanking press and automatically feed strip stock material from a magazine on top of the machine, through a preheating oven and into a roller feeder, thence into the blanking die. It is synchronized with and driven by an adjustable cam mounted on the end of the press crankshaft, with a connecting rod to roller feeder. Series **(To page 46)**

BLACK BROS. rotary laminating press, which is shown bonding a melamine laminate facing to a kitchen worktop.

*Prices are deemed to be F.O.B. sellers' plants (unless otherwise stated), are for "standard" models, and are subject to change without notice. The publishers and editors of MODERN PLASTICS do not warrant and do not assume any responsibility whatsoever for the correctness of the same, or otherwise.

Because Model H-400 has proved so efficient . . . Customers have demanded a companion Van Dorn 3 oz. Plastic Press

Owners Acclaim the Performance of this 3 oz. Press



FEATURES OF
VAN DORN
H-300 INJECTION PRESS

HIGH PLASTICIZING CAPACITY up to 65 pounds plus per hour

HIGH CLAMPING PRESSURE—75 tons

HIGH SPEED OPERATION up to 1200 dry cycles per hour

FAST MOLD SET UP—toggle assembly easily adjusted for mold thickness

ADJUSTABLE TOGGLE STROKE 4" to 8" Standard and 4" to 12" optional

LARGE PLATENS accommodate molds up to 9⅞" x 16"

FOUR TIE BARS

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SELECTIVE CONTROL to change from automatic to semi-automatic to hand operation

INJECTION PLUNGER & TOGGLE Speed adjustable

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ONE SHOT LUBRICATION—Standard equipment

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NEW MACHINERY-EQUIPMENT

(From page 44)

65 models handle strip stock from 0.5 to 6.5 in. wide, have larger, more efficient ovens than older models. With these feeders, one attendant can service a battery of presses and can do other things while press is on cycle. *Technical Design & Development Co., Inc., 465 Naugatuck Ave., Devon, Conn.*

Portable tumble-finisher

The Model RA Rollabrader is an 0.5-cu. ft. barrel finisher that is simply a free drum that is turned by friction with driven neoprene rollers on which it rests. Has variable-speed drive, orange vinyl barrel lining, lifting handles on both barrel and bed. Intended for finishing of short runs of small parts, experimental processing, and the like. Weight is 102 lb., price is $168.50. *Rampe Mfg. Co., 14915 Woodworth Ave., Cleveland 10, Ohio.*

RAMPE MFG. CO. Model RA Rollabrader is designed for finishing of short runs of small parts, experimental runs, etc.

Light-fading and weathering tester

The GFB light-fading tester is a device for accelerating natural sunlight effects on all materials. It is useful in research, testing, and to some extent in production control, of materials that must withstand sunlight. The filtered xenon lamp closely reproduces the solar spectrum over the range from 3000 to 8000 Angstroms, and is especially close in the UV region. Specifications are as follows: sunlight intensity is 15,000 ft.-candles at specimens; sample space temperature is 100 to 150 $\pm$ 2° F.; space humidity is up to 50%, indicated. Elapsed time is indicated. Power consumption is 2 kw. at 4.5 kva., on either 220 or 440 volts. The weathering tester is same as the light-fading tester with added features: relative humidity may be controlled between 20 and 95%; programming of sunlight and rain may be preselected. *G. F. Bush Associates, Box 175, Princeton, N. J.*

Small automatic molder

The Dowding Series II injection machine is a fully automatic model dry-cycling in 3 sec. and shooting 23.6 cc. —about ¾ oz. of polystyrene. Plasticating capacity, very high for the machine's shot capacity, is 20 p.p.h. This is accomplished through an internally fluted heating cylinder; another feature of the cylinder's design is that the injection plunger acts directly on the melt, minimizing pressure loss. Controls, mounted on a separate panel, consist of two process timers, three heater controls, hydraulic pump control. A safety device prevents the mold from closing if it is not cleared. A special model of this machine is designed for molding 6/6 nylon. *Dowding & Doll, Ltd., 346 Kensington High St., London, W.14, England.*

Continuous casting machine for urethane elastomers

The casting of solid urethane-elastomer pieces has been a somewhat messy operation because of the difficulties of mixing the reactive components. A new production machine automatically mixes and casts the resin on demand. Machine components include supply tanks and valves, variable-speed pumps, and blending devices. Parts weighing from 4 oz. to 96 lb. have been successfully cast on the machine and scale of production, which used to be limited by the hand-mixing of small batches, now is limited only by the number of machines on the line. The new equipment was developed by *Mobay Chemical Co., Pittsburgh 34, Pa.,* who plans to license its production and use.

Small metallizer

The Model 3144 bell-jar metallizing unit is intended primarily for developmental work or limited-volume deposition of one or more materials under vacuum. Power supply, pumping system, etc., are all contained in a 3- by 4-ft. steel cabinet. Conveniently located controls simplify operation and the bell-jar is raised and lowered by a geared winch. A choice of two types of bell-jar is offered, both 30.5 in. high. One is an 18-in.-diameter Pyrex dome with perforated metal shield; the other is a 24-in.-diameter steel dome with two eye-level view ports. The 28-in. baseplate has a central 6-in. vacuum pumping port and 17 1-in. holes for feed-throughs. In four of these are mounted filament posts rated at 6v., 125 amp.; three have high-voltage feed-throughs rated either at 4000 v., 10 ma., or 115 v., 10 amperes. There are also four work-support posts and six spare holes. *NRC Equipment Corp., 160 Charlemont St., Newton, Mass.*

Fade tester

The Model FDA-RC Fade-Ometer can be operated under either of two sets of conditions: simulation of the cycling effect and high humidity conditions of the daylight exposure method, or conditions that correlate well with exposure to sunlight between 9 a. m. and 3 p. m. Existing Fade-Ometers can be converted to the new model by addition of new features. *Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago 13, Ill.*

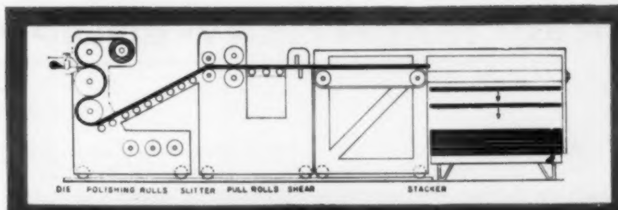
Hot-forming tool

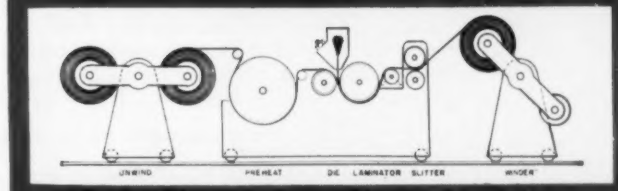
The Plasti-Form electrically heated tool consists of a heated tube with handle, cord, and five quick-attach aluminum heads of different sizes (see photo below). **(To page 48)**

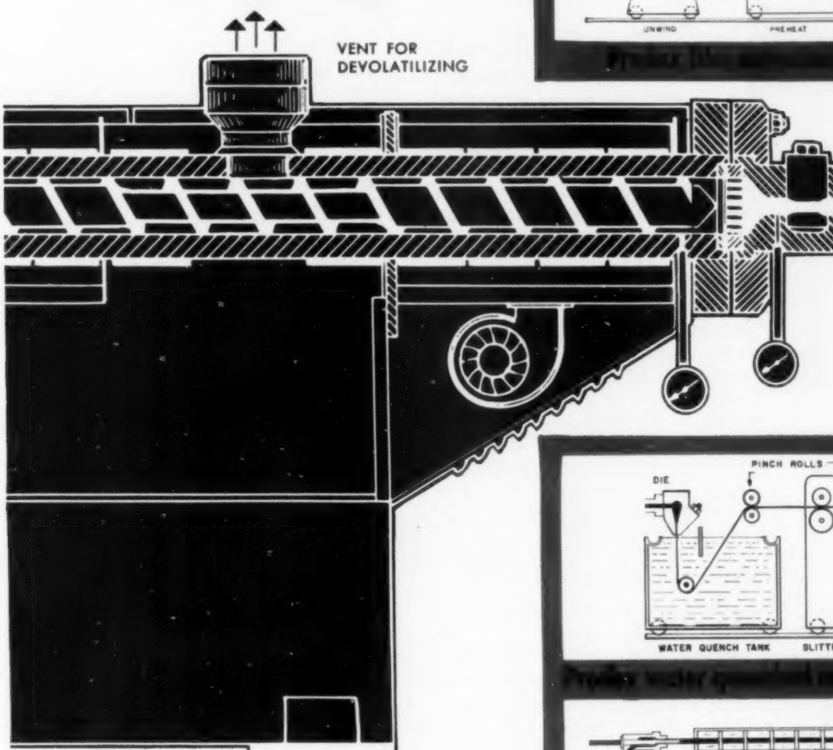
ERA ENGINEERING electrically heated forming tool is shown with five different quick-attach aluminum forming heads.

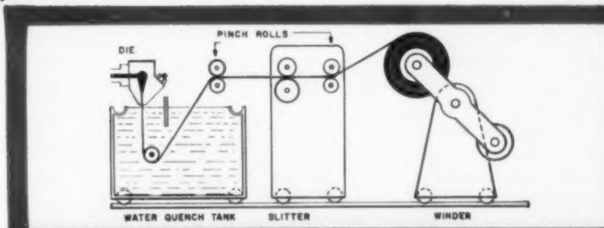
PRODEX EXTRUSION and COMPOUNDING SYSTEMS

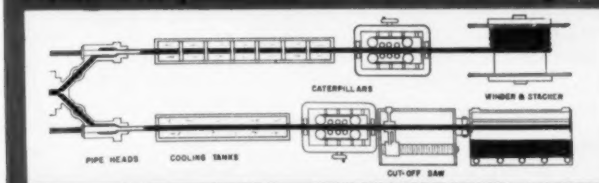
the last word in Plastics Extrusion Technology.

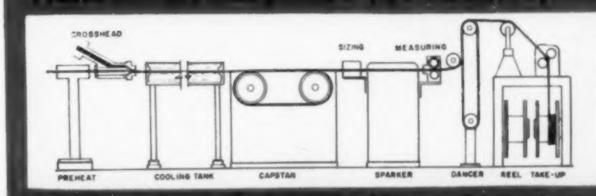












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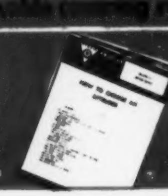


ASK FOR 50 PAGE ILLUSTRATED BULLETIN E-3

NEW MACHINERY-EQUIPMENT

(From page 46)

Tests have indicated that the about 400° F. head temperature provides suitable heating for most plastics working. Adequate control of heating is obtained by controlling pressure and time of application, it is claimed. The tool has been useful in forming thermoplastic sheet and in laying up fibrous glass prepregs. Price complete: $13.95. *Era Engineering, Inc., 1009 Montana Ave., Santa Monica, Calif.*

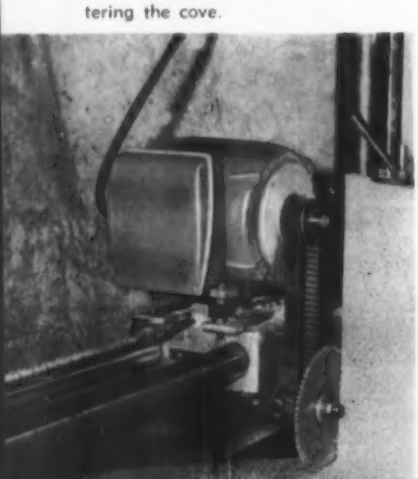
Banbury safety device

An electronic safety device that automatically shuts off a Banbury mixer when its internal temperature exceeds a safe limit is now available. The development of this device was stimulated by a major fire in a rubber plant in 1955, which occurred because of an operator error. The device, a joint development of U. S. Rubber and Thermo-Electric engineers, is called the Banbury Temperature Limiter and is made by *Thermo-Electric Co., Inc., Saddle Brook, N. J.*

Combination panel saw

The latest addition to the Hendrick line, the MLR-V-6, is designed to make 45° miter joints in countertops with their vertical backs, cutting both the horizontal and vertical members in a single pass. This guarantees precision fitting of the corner joints on both surfaces. Unit consists of a fabricated steel table with plywood top, supplied with an adjustable mitering fixture against which the angle blank is placed and clamped. The saw is equipped with extra-long columns, braced to a wall or overhead structure at both ends, which mount lead screws driven by worm gear and chain-and-sprocket system under the main channel structure. Saw blade is 8 in. in diameter, has 72 carbided teeth, is driven by 1.5-hp. motor. *Hendrick Mfg. Corp., Marblehead, Mass.*

HENDRICK Model MLR-V-6 combination panel saw, showing the blade as it has completed cut of 18-in. back and is entering the cove.



Fluid-tight blind rivets

Blind riveting is often useful in joining plastics. Pop and Imex rivets are both set by pulling a mandrel into the rivet shank and expanding the shank to a controlled degree. In the case of the Imex rivets, the head of the mandrel is incased within the rivet and seats tightly against a shoulder formed during the setting operation. So set, Imex rivets are said to be air- and water-tight at pressures up to 500 p.s.i., and they are highly resistant to vibration. There are two types: 1) with a short-break mandrel that breaks off directly under the blind head, and 2) with a long-break mandrel that leaves more of the stem to act as a reinforcing steel core for the rivet. Available in aluminum in 0.125- and 0.187-in. diameters. *United Shoe Machinery Corp., Pop Rivet Div., West Medway, Mass.*

Plastics welding equipment

The Model PVS welder permits the average operator to weld up to 48 in./min. of PVC or PE sheet, using ⅛-in. welding rod. The principal change over previous model appears to be a new tip that automatically positions and feeds rod, leaving other hand free to handle work. Tip can be fitted to present Seelye welders. Five interchangeable heating elements range in wattage from 180 to 600 at 110 volts. *Seelye Craftsmen, 984 Central Ave., Minneapolis 13, Minn.*

Hopper loader

Dusting has been an annoying problem in the loading of molding machine hoppers. A new hopper-loader elevates dusty feeds to hoppers through a closed tube by a gentle screw-conveying action that eliminates dusting. The conveyor is available in two sizes to deliver from 150 to 1000 lb./hr. A torque-limiting cut-out on the screw drive stops the screw when the hopper contents reach the desired level. Feeding is resumed after a timed interval. The new conveyor is mounted on its own stand, plugs into any 110-v. (AC) outlet. *Whitlock Associates, Inc., 21655 Coolidge Hwy., Oak Park 37, Mich.*

WHITLOCK hopper loader eliminates dusting by elevating dusty feeds to hoppers thru closed tube.

High-vacuum pumps

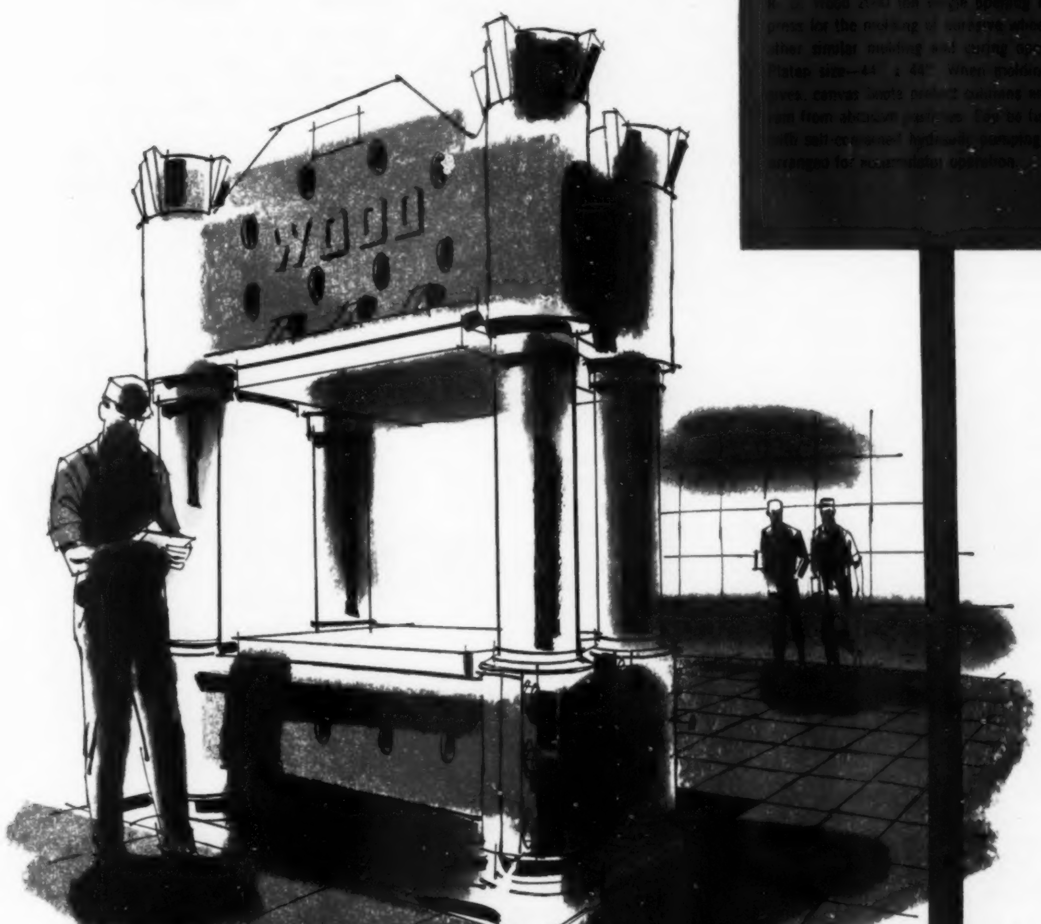
Two new oil-diffusion pumps, useful in vacuum metallizing, are claimed to provide peak speeds up to 138% higher than conventional pumps of comparable size. For example, the 4-in. model pumps at 26.5 cu. ft./sec. over the low-pressure range from 2×10^{-5} to 2×10^{-8} mm. Hg. Limiting forepressure is 0.5 to 0.6 mm. Hg. Design innovations that make such speed possible include direct heating of pumping fluid with immersion heater, extension of heater assembly to provide additional heating to vapor phase, new jet design. Casing is up to 8 in. shorter than usual, slightly wider. Both the 4- and 6-in. models have operating pressure ranges from 0.01 to 7×10^{-7} mm. Hg. *Consolidated Electrodynamics Corp., Rochester Div., Rochester 3, N. Y.*

Surface thermometers

The Thermophil line of electronic surface thermometers can measure temperatures of surfaces (including wire surfaces) or liquids over the temperature range from −328° to +845° F. (−200 to +450° C.) with an accuracy of ±0.25°F. A typical instrument has three scale ranges and reads from 30 to 410° F. Full-reading response times are 5 and 15 sec. for liquids and surfaces, respectively. Battery operated, these portable thermometers measure 7 by 5 by 2.25 inches. Sensitive element is thermistor, whose resistance is measured by bridge circuit, amplified, and indicated. Over 100 different and interchangeable probe designs are available for the 26 instruments of the line. Some types can be operated off house current and installed in panel boards. Many other accessories. *Atkins Technical, Inc., 709 Marion Building, Cleveland 13, Ohio.*—**End**

How to save money on your next press: apply your specs to a basic R. D. Wood design

The result will be exactly *what you want*—just as surely as if you had it designed from scratch. And its cost will be much lower. Working with numerous basic models, R. D. Wood engineers can save considerable design time and expense, and still incorporate *your* specifications in the finished machine. You're sure of its quality, too. For every Wood Press is built by experts using selected materials. This brings additional saving from smooth, dependable performance; fast, economical production; trouble-free operation. *Before* you begin planning your next hydraulic press, consult Wood.



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U.S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

Resins. H. G. Cooke, Jr., (to Devoe & Raynolds). U. S. 2,864,805, Dec. 16. Epoxide resins.

Resins. M. DeGroote and K. T. Shen (to Petrolite). U. S. 2,864,806, Dec. 16. Oxyalkylation derivatives of polyepoxide modified phenolic resins.

Polyamides. J. F. Nobis and H. Greenberg (to National Distillers). U. S. 2,864,807, Dec. 16. Polyamides from branched chain diamines.

Terpolymers. A. F. Harris (to Monsanto). U. S. 2,864,808, Dec. 16. Terpolymers of vinyl acetate maleic anhydride and a styrene component.

Resins. R. V. Jones and C. N. Moberly (to Phillips). U. S. 2,864,809, Dec. 16. Hydrogenated polybutadiene.

Copolymers. H. J. Hagemeyer, Jr. and E. L. Oglesby (to Eastman Kodak). U. S. 2,865,872, Dec. 23. Graft copolymers of acrylonitrile.

Interpolymers. R. M. Christenson (to Pittsburgh Plate Glass). U. S. 2,865,-874, Dec. 23. Interpolymers of alkyd resins, vinyl halides and vinyl esters.

Polysiloxanes. P. L. de Benneville and M. J. Hurwitz (to Rohm & Haas). U. S. 2,865,884-5, Dec. 23. Unsaturated polysiloxanes.

Resin. S. O. Greenlee (to Devoe & Raynolds). U. S. 2,865,886 and 2,865,-888, Dec. 23. Polyethylene polyamine-epoxide compositions.

Resins. J. B. D. Mackenzie (to Ciba). U. S. 2,865,887, Dec. 23. Glycidyl ethers of polymerizable phenol compounds.

Condensates. R. W. Auten (to Rohm & Haas). U. S. 2,865,890, Dec. 23. Condensates of isophthalic dihydrazide, formaldehyde, and butanol.

Copolyesters. R. H. Michel (to Du Pont). U. S. 2,865,891, Dec. 23. Linear copolyesters.

Copolymers. C. C. Unruh and D. A. Smith (to Eastman Kodak). U. S. 2,865,893, Dec. 23. Hydrolysis copolymers of vinyl acetate and unsaturated carbamates.

Polyamides. H. Greenberg and R. W. Horst (to National Distillers). U. S. 2,865,894, Dec. 23. Polyamides from dicyclohexyladipic acid.

Polyamides. J. H. F. Pieper and J. A. V. N. Stauch (to Hercules). U. S. 2,865,895, Dec. 23. Polyamide production.

Resins. B. Raecke, R. Kohler, and H. Pietsch (to Henkel). U. S. 2,865,897, Dec. 23. Epoxy alkyl esters of aromatic carboxylic acids.

Polymers. M. J. Hurwitz and P. L. de Benneville (to Rohm & Haas). U. S. 2,865,899, Dec. 23. Polymers of vinylthioalkoxytrimethylsilane.

Resins. E. J. Buckler and D. C. Edwards (to Polymer). U. S. 2,865,901, Dec. 23. Bromination of isoolefin-polyolefin copolymers.

Polymerization. L. Seed (to Imperial Chemical). U. S. 2,865,903-4, Dec. 23. Polymerization of ethylene.

Copolymer. J. C. Fang (to Du Pont). U. S. 2,866,767, Dec. 30. Copolymers of unsaturated compounds and a diglycidyl ester.

Resin. I. I. de Jong (to Du Pont). U. S. 2,866,770, Dec. 30. Urea resin modified with a polymerizable monoamide.

Polymers. W. R. Nummy (to Dow). U. S. 2,866,776, Dec. 30. Polysulfide liquid polymers.

Polymers. J. E. Pritchard and P. J. Canerino (to Phillips). U. S. 2,866,-779, Dec. 30. Polymeric 2-hydroxyalkyl quaternary salts.

Resin. G. O. Hillard, Jr. and L. W. McLean (to Esso). U. S. 2,866,780, Dec. 30. Resins polymerized with Friedel-Crafts catalyst.

Polysiloxanes. D. T. Hurd and R. C. Osthoff (to G. E.). U. S. 2,867,599, Jan. 6. Vulcanizable vinyl-containing polysiloxanes.

Resins. A. Coutras (to American Cyanamid). U. S. 2,867,600, Jan. 6. Benzoguanamide-aldehyde resin.

Copolymer. B. F. Landrum and R. L. Herbst, Jr. (to Minnesota Mining). U. S. 2,867,601, Jan. 6. Graft copolymer of fluorocarbon polymer.

Blends. M. M. Safford and R. L. Myers (to G. E.). U. S. 2,867,603, Jan. 6. Blends of organopolysiloxane, polybutadiene, and di-alpha-cumyl peroxide.

Organopolysiloxane. A. R. Gilbert (to G. E.). U. S. 2,867,606, Jan. 6. Polymerizable organopolysiloxane solutions.

Compositions. Y. Jen (to American Cyanamid). U. S. 2,867,607, Jan. 6. Polyamide compositions.

Copolymers. B. F. Landrum and R. L. Herbst, Jr. (to Minnesota Mining). U. S. 2,867,608, Jan. 6. Copolymers of fluorocarbons.

Resins. W. M. Edwards, I. M. Robinson and E. N. Squire (to Du Pont). U. S. 2,867,609, Jan. 6. Polypyromellitimides.

Polymers. A. D. F. Toy and R. S. Copper (to Victor). U. S. 2,867,610, Jan. 6. Polymers of dialkenyl beta (carboxyalkyl) alkane-phosphonates.

Resins. A. S. Teot (to Dow). U. S. 2,867,611, Jan. 6. Polysulfonyl chlorides of styrene resins.

Polymerization. G. Pieper, E. Stein, and H. F. Rickert (to Bayer). U. S. 2,867,612, Jan. 6. Polymerization of ethylene.

Resins. R. Ledercq and R. O. Paquet (to Union Chimique Belge). U. S. 2,867,644, Jan. 6. Abietyl alcohol resins.

Copolymerizing. S. B. Luce (to Swift). U. S. 2,868,740, Jan. 13. Copolymerizing an acrylic acid with protein.

Resin. R. M. Frey (to McGraw-Edison). U. S. 2,868,746-7, Jan. 13. Furfural-alcohol-thiophene resin.

Composition. D. N. Staicopoulos (to Du Pont). U. S. 2,868,760, Jan. 13. Methacrylate resin.

Compositions. S. E. Jolly (to Sun Oil). U. S. 2,868,761, Jan. 13. Compositions of vinyl aromatic compounds.

Blends. W. G. Oakes (to Imperial Chemical). U. S. 2,868,762, Jan. 13. Mixtures of polyethylenes.

Blend. C. W. Montgomery (to Ethyl). U. S. 2,868,763, Jan. 13. Blend of vinyl resins.

Copolymers. O. K. Johannson (to Dow Corning). U. S. 2,868,766, Jan. 13. Organosiloxanes.

Curing. H. A. Cyba and R. B. Thompson (to Universal Oil). U. S. 2,868,767, Jan. 13. Curing epoxy resins.—**End**

ARGUS HAS THE ANSWERS

Argus Chemical Corporation is a pioneer in the specialized manufacture of stabilizers and plasticizers for the vinyl processing industry. Intensive, continual research and product improvement over the years are responsible for the position of leadership which Argus occupies in the field today. Argus Mark Stabilizers and Drapex Plasticizers are industry standards.

Argus gets the answers—cat-quick! You can't keep *your* customers waiting when something goes wrong with a vinyl formulation. That's why more and more vinyl processors call on Argus, where they get quick, accurate answers to their problems. Our laboratory research staff works with vinyl stabilizer and plasticizer problems around the clock.

What is your problem?

- heat stability
- light stability
- freedom from roll plating
- clarity
- heat sealing
- printability
- good embossing
- protection from sulphide staining
- retention of physical properties
- good hand
- low temperature flexibility
- resistance to soap and water extraction
- viscosity stability
- low viscosity
- freedom from copper staining
- resistance to staining
- good impact strength
- good weathering

Tell us your need. Often it can be solved by one of our line products or a specific combination of them. In some cases basic, original research is needed. And technical service from Argus is equivalent to having your own vinyl research laboratory right on the spot.

MARK STABILIZERS

Quality control makes a difference. Every batch of Argus products has the same, pure-bred quality! That's one of the advantages of specifying Argus Mark stabilizers.

It takes careful manufacturing and continuous testing by Argus research to meet this high standard. Most vinyl stabilizers are complex mixtures, so that merely checking physical specifications such as specific gravity and refractive index are not necessarily indicative of standard performance. To insure the consistency and quality of all Argus materials, we make up a sample vinyl formulation for every stabilizer batch and test it for heat stabilizing action.

This constant testing under conditions of actual use is the only way you can be sure of getting top quality stabilizers. It is one of the reasons for the high position the line of Mark stabilizers (see below) holds in the industry.

MARK M – barium-cadmium complex with high heat and light stabilizing efficiency.

MARK PL – zinc complex that exhibits a synergistic action on stability when used in conjunction with other Mark stabilizers.

MARK XI – coprecipitated barium-cadmium laurate with excellent heat and light stabilizing action.

MARK TT – barium-cadmium soap recommended for stabilization of high phosphate formulations in combination with Mark M.

MARK WS – barium-cadmium complex specifically designed for use in the extrusion or calendering of rigid polyvinyl chloride, and other severe applications.

MARK C – most efficient chelating material developed. Used in conjunction with barium-cadmium systems to improve heat and light stability.

MARK XX – antioxidant or chelating agent used to increase the efficiency of a saturated metallic soap or a metallic salt.

MARK XV – cadmium containing chelating agent which markedly improves the heat and light stabilizing action of lead, barium, calcium and strontium stabilizers.

MARK E – a strontium-zinc laurate with a low degree of toxicity for use where complete freedom from sulphide staining is a necessity.

MARK GS – zinc containing complex organic liquid stabilizer for plastisols to meet the requirements of outstanding air release and "bubble break" characteristics and complete freedom from mold plate-out.

MARK X & MARK A
– alkyl tin mercaptides specifically recommended for the stabilization of crystal-clear unplasticized compounds.

MARK 225 & MARK HH
– vinyl stabilizers for floor tile formulations incorporating iron containing asbestos.

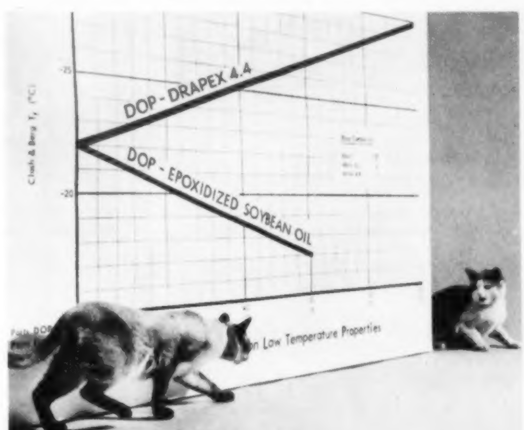
MARK KCB – barium-cadmium-zinc heat and light stabilizer especially effective for plastisols and organisols and all resins which tolerate zinc stabilizers.

... AND NOW MARK LL

Less gives you more. Powerful, highly efficient, Mark LL gives you more heat and light stability, and better maintenance of the true tones of sensitive organic pigments, than any other vinyl stabilizer on the market.

● Technical Bulletin #1 gives detailed information on Mark stabilizers. Write for your copy and/or samples.

DRAPEX PLASTICIZERS



Pure-bred epoxy . . . at an alley-cat price. Argus Drapex 4.4 is the blue-ribbon champion in epoxy plasticizers. The lower specific gravity of Drapex 4.4 reduces volume costs by 6 percent. You can *economize* by replacing ordinary epoxy plasticizers with Drapex 4.4 in your vinyl formulation and achieve, in addition:

- low temperature flexibilty
- low volatility

- improved heat and light stability
- low viscosity and viscosity stability in plastisols
- ease of handling
(due to low viscosity and low freezing point)
- good weatherability

● Argus Drapex plasticizers include:

DRAPEX 3.2 – octyl epoxy stearate having all the advantages of Drapex 4.4 and suggested for those applications which require the best possible low temperature flexibility.

DRAPEX 4.4 – octyl epoxy stearate having a higher epoxy value than Drapex 3.2 with resultant superior heat stabilizing action.

DRAPEX 7.7 – high solvating primary plasticizer with polymeric properties. Recommended where resistance to staining by such materials as asphalt, shoe polish, grease, mustard, ink, lipstick, etc., is an important consideration.

● Technical Bulletin #3 gives detailed information on Drapex plasticizers. Write for your copy and/or samples.

ARGUS RESEARCH

Curiosity that's bred in the bone is the hidden ingredient in every Argus product. It enables Argus research to keep turning out better and better vinyl plasticizers and stabilizers at lower and lower cost.

Many of Argus' superior products have been developed, or improved, in the course of finding answers to specific technical problems posed by customers. The reason: every member of the Argus research staff is a recognized authority in the vinyl field.

ARGUS PATENTS IN THE VINYL FIELD ● UNITED STATES–2,564,646 · 2,641,588 · 2,641,596 · 2,680,107 · 2,704,756 · 2,716,092 · 2,723,965 2,725,365 · 2,726,227 · 2,726,254 · 2,752,325 · 2,759,906 · 2,789,957 · 2,789,963 · 2,798,875 · 2,837,490 · 2,860,115 · 2,870,119 · 2,870,182 · 2,872,468 CANADA–512,208 · 546,804 · 550,235 · 554,108 · 563,643 · 563,644 - BELGIUM–539,563 · 557,489 · 562,417 · 570,394 - FRANCE–1,127,671 · 1,175,086 GERMANY–1,008,908 - GREAT BRITAIN–737,508 · 740,392 · 740,397 · 743,304 · 748,228 · 752,053 - ITALY–536,498 · 574,736 · 583,225 - SPAIN–235,352

If you want the right answers, ask Argus.
We'll find them for you in our regular line
of Mark Stabilizers and Drapex Plasticizers
–or in basic, original research on your problem
by our Technical Service Staff.

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LITHO IN U.S.A.

WORLD-WIDE PLASTICS DIGEST

Abstracts from the world's literature relative to plastics. For complete articles, send requests direct to publishers. List of addresses is at end of this section.

General

Drafting standard on plastics aids designers. H. E. Minneman. Magazine of Standards 29, 362-63 (Dec. 1958). Section 11 of the American Drafting Standard Manual concerned with plastics is announced. This is American Standard Y14.11-1958, available from the American Standards Association for $1.50.

Spotlight on polymers. Chem. Eng. News 37, 39-40 (Jan. 5, 1959). Developments in 1958 include among others, a one-shot system to make urethane foams from isocyanates and polyethers, improved epoxy resins, and acrylic plastic coatings.

Cellophane meets competition. Chem. Eng. News 37, 28 (Jan. 19, 1959). Production figures on cellophane are presented.

Marketing in the Middle East. S. Gramaglia. Poliplasti 6, 41-44 (Nov./Dec. 1958). The use of plastics and developments in the plastics industry in the Middle East (Arabia, Iran, Turkey, etc.) are reported. (In Italian).

Materials

Redox resins scent commercial rewards. Chem. Week 84, 20 (Jan. 3, 1959). The reactions of quinones with organic hydroxyl compounds or aldehydes produce redox resins. These may have applications as ion exchange products, catalysts, inhibitors, and in color photography.

Allyl polymerizations. R. C. Laible. Chem. Reviews 58, 807-43 (Oct. 1958). The literature on allyl polymerizations is reviewed and organized. The types of polymers or resins resulting from the reactions of a large number of allyl compounds are tabulated. These range from liquid polymers to rubberlike materials to hard brittle resins. 483 references.

What's ahead for castable polyurethanes. G. M. Le Fave and R. Gamero. Industrial Laboratories 10, 43-46 (Feb. 1959). The synthesis and properties of cast polyurethane plastics are discussed. Polyesters and polyethers with terminal hydroxyl groups react with diisocyanates in the presence of special catalysts to produce such products. These products are flexible down to —90° F., and are abrasion and chemical resistant.

Development of steam-resistant fiberglass-reinforced plastics. E. G. Bobalek, W. M. Ellslager, and T. Harris. Plastics Tech. 5, 33-38, 48 (Jan. 1959). Various constructions of glass fiber reinforced plastics were made and tested. Particular attention was given to change in properties as a result of exposure to sterilizing temperatures in steam. Hydrolysis-resistant resins, dry reinforcement and resin, synthetic fiber overlays, selected and carefully controlled cure operations, and care in selecting materials going into the laminate are necessary to obtain best resistance to steam.

Compounding of polyvinyl chloride. A. G. Lopez. Ion 18, 335-38 (1958). A discussion is given of the properties obtained by the use of more than 20 plasticizers, 13 stabilizers, various lubricants, colorants, pigments, and extenders in PVC. Best results are obtained by adding a thoroughly homogenized mixture of the additives to the base polymer, homogenizing, digesting for 12 hr., and heating to form the gel.

Pyramid plots pattern for new polymers. Chem. Week 83, 73-74 (Dec. 6, 1958). Triangular graphs are used to select compositions of terpolymers.

Pilot-scale polycarbonate. Ind. Eng. Chem. 50, 38A, 40A, 42A (Dec. 1958). The properties of a new thermoplastic, polycarbonate, are described.

Effect of radiation on polysiloxanes. K. H. Kraus. Kunststoffe 48, 564-66 (Dec. 1958). The results of various tests on the effect of radiation on polysiloxanes are discussed and compared.

Compounding polyvinyl acetate adhesives. Adhesives Age 1, 16-20 (Dec. 1958). The principles involved in compounding polyvinyl acetate emulsion adhesives are presented.

Bulk polymerization of methyl methacrylate. Z. Sokolski and P. Szota. Przemysl. Chem. 34, 464-8 (1955). The influence of the apparatus (aluminum, copper, and steel) on the bulk polymerization of methyl methacrylate was studied. The influence of the purity of the monomer on the rate of polymerization and quality of the polymer was also investigated. Times and temperatures for good yields are tabulated. Addition of ThO_2 or SiO_2 in amounts of 1 to 12% during polymerization was found advantageous.

Properties of foamed cold-setting urea-formaldehyde resins. H. Baumann. Kunststoffe 48, 362-64; 406-08 (Aug.; Sept. 1958). Portable foaming equipment which can be used to produce foamed cold-setting urea-formaldehyde resins in situ, has proved very popular in the building industry and in the mines. New fields of application can only be developed after the materials have been fully investigated in many different fields and under varying conditions of service. For these reasons the foamed material was tested under different conditions, ensuring that the method of test resembled as closely as possible the actual conditions of use. These tests and the results obtained are described.

Commercial grades of melamine molding powders: Their present position and applications. W. Lohmann. Kunststoffe 48, 433-36 (Sept. 1958). New melamine molding compounds have been developed in recent years. The typical properties of these compounds, which are largely governed by the type of resin used and the fillers employed, are given in the appropriate German Standards. The processing of these compositions is presented, as well as their applications.

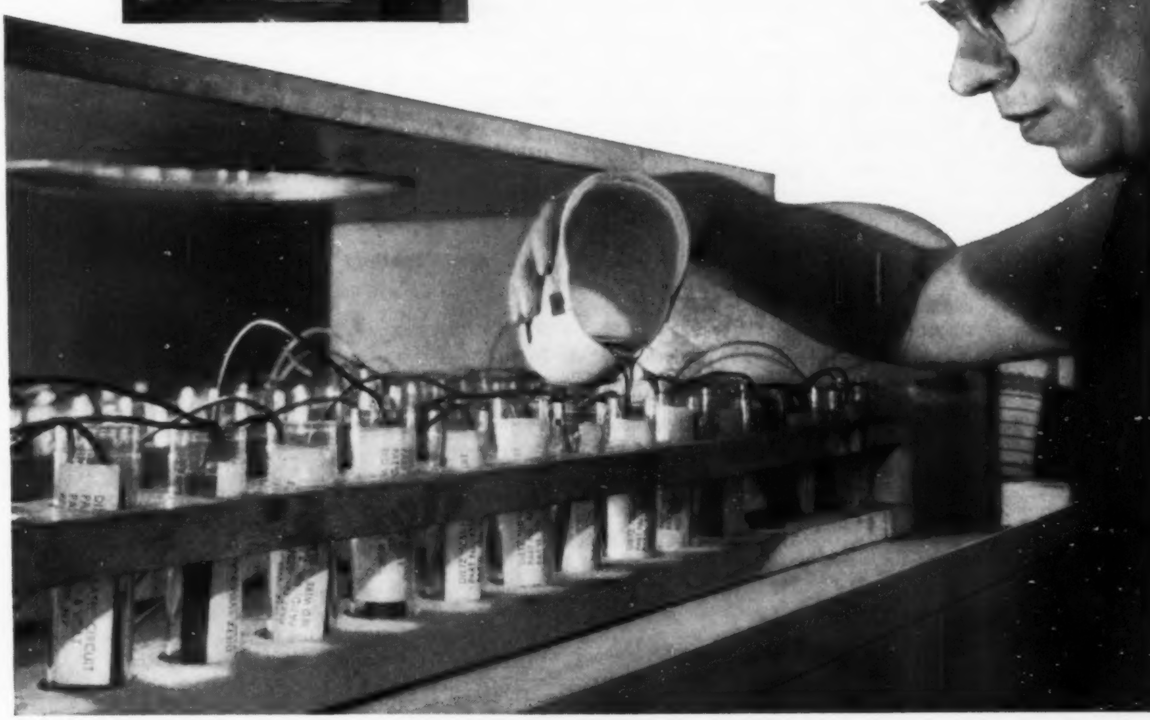
Molding and fabricating

Problems related to the thermoforming of toughened polystyrene. E. L. Williams. Brit. Plastics 31, 518-21 (Dec. 1958). The four main types of forming processes, simple vacuum, drape, plug, and blister blowing, are described in general terms. Some practical aspects of forming polystyrene sheet for structural or load-bearing applications are discussed. Cast phenolic and epoxy molds are used **(To page 58)**

RCI EPOTUF EPOXY RESIN

"It has been essential in development of our transistorized warning light" — R. E. Dietz Company, Syracuse, N. Y.

Since 1840 the Dietz Company has lighted America — with everything from kerosene lamps to auto headlights. In developing a new compact warning signal light, the company was faced with the problem of protecting the circuitry. They needed a material with strength, low potting temperature, waterproof and non-conducting properties. Reichhold EPOTUF Epoxy met every specification. For superior insulation of miniaturized components, investigate RCI EPOTUF Epoxy Resins — REICHHOLD CHEMICALS, INC., RCI Building, White Plains, N. Y.



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(From page 56)

in vacuum-forming techniques but require special preparation. The choice of proper material thickness is important and is considered in detail. Methods of forming preprinted sheet stock are also presented.

Improving paint adhesion on phenolic surfaces. Metal Finishing *56*, 57, 63 (Sept. 1958). An epoxy coating that adheres permanently to molded phenolic plastic surfaces has been developed. Low cost phenolic resins can now be used and the molded item can be enamelled in almost any color. The formulation has been successfully applied to glass, zinc, wood, and stainless steel. The usefulness of the technique in an application to the interior of a camera is discussed.

Applications

Now you can specify plastics pressure vessels. A. J. Wiltshire. Materials in Design Eng. *48*, 101-04 (Nov. 1958). Spherical plastics pressure vessels for military use are designed for 3000 p.s.i. and a temperature range of −65 to 200° F. The materials combination found to be most effective was a continuous-filament glass fiber reinforcement, an epoxy resin binder, and a styrene-butadiene lining. The winding provides for the fibers to be primarily in tension when the sphere is stressed. Comparisons of plastics and metal vessels are given. One of the most important advantages of the plastics as compared to metal is its resistance to shattering on impact of gunfire. The corrosion resistance is also superior.

Use of plastics tape, strips, and tubing in room dividers. E. Jakubowski and F. Nitsch. Kunststoffe *48*, 593-96 (Dec. 1958). The use of plastics for interior decoration is discussed and illustrated.

Plastics for liquid rocket engines. E. J. Zeilberger. Astronautics *3*, No. 8, 26-7, 76-9 (1958). Developments in epoxy, phenolic, polyester, and silicone resins to form structural materials for liquid rocket engines are described.

Organic finishing of aluminum and its alloys. L. F. Spencer. Metal Finishing *56*, No. 8, 58-61, 69 (1958). A general discussion is given of the use of organic finishes in aluminum and its alloys, including surface preparation, primers, and top coatings. The latter include styrenes, polyamides, acrylates, ethylcellulose, vinyls, alkyds, melamines, silicones, phenolics, ureas, and furans.

Properties

A study of the effects of corona on polyethylene. E. J. McMahon, D. E. Maloney, and J. R. Perkins. Insulation *4*, 14 (Dec. 1958). A study of the effects of corona on conventional low-density polyethylene revealed the existence of a phenomenon called electro-mechanical stress-cracking or corona-mechanical stress-cracking. Failures always occur in areas under tensile stress, and the greater the elongation, the sooner the failure. If mechanical stresses are relieved by annealing, the frequency of failure decreases. Failure occurs more readily in air than in nitrogen. Relative humidity has a large effect; the corona life at wet condition was 20 times longer than at dry condition.

Measurement of melting point or flow temperature of polymers with an automatic melting point apparatus. K. Ueberreiter and H. J. Orthmann. Kunststoffe *48*, 525-30 (Nov. 1958). A melting point apparatus is described which is easy to handle and fully automatic. It is intended to measure the melting point of crystalline micro- and macromolecular materials, or to give immediate information on the flow properties of polymeric substances. The instrument may be calibrated to give curves from which the molecular weight can be estimated.

Assessment of cure. A. A. Tomkins. Plastics Inst. Trans. *26*, 389-414 (Oct. 1958). Methods for determining the state of cure of thermosetting plastics include acetone solubility, plastic yield, electrical loss measurements, blister temperature, hardness, resistance to chemicals, and change in properties on afterbaking. It is concluded that there is a need for a faster, more reliable test for state of cure.

Characterization of polyesters by infra-red spectrometry. A. Giger, J. Henniker, and L. Jacque. Chim. et Ind. *79*, 757-69 (June 1958). A basic collection of 40 polyesters was prepared by binary combination of one of eight diacids with one of five diols; its spectral analysis revealed several bands of frequencies, some of them pertaining to the glycolic residues, others to the acidic residues. Possible interpretations are suggested for several bands. The extension of the research to polyesters comprising polyols or polyacids other than those of the basic series allows satisfactory control of the validity of the method.

A high shear rate capillary rheometer for polymer melts. E. H. Merz and R. E. Colwell. ASTM Bull. No. 232, 63-67 (Sept. 1958). A rheometer for polymer melts is described which will measure the melt properties of polymers at usual processing temperatures and rates of shear. It is shown that a relatively large length-to-diameter ratio of the rheometer capillary is required before viscosities can be measured independently of the capillary geometry.

Temperature dependence of heat conductivity of macromolecular substances. W. Holzmueller and M. Muenx. Kolloid Zeit. *159*, 25-8 (1958). The thermal conductances of PVC, polymethyl methacrylate, polystyrene, and polyamide were measured. The absolute stationary heat condition was determined by a two-plate method using ring heating.

Testing of polyvinyl chloride electrical formulations. G. W. Ashworth, J. R. Darby, W. A. Koerner, and R. H. Munch. Wire and Wire Products *33*, 407-11, 467-68 (1958). The relations between the electrical properties and the variations in ingredients of 36 plasticized and filled PVC formulations for electrical insulation were studied.

Testing

Tensile impact tests on films. R. H. Carey and M. S. Nutkins. Modern Packaging *32*, 147-52, 207, 209 (Sept. 1958). Data obtained by a tensile-impact test correlated with a bag-drop test, but not with a falling-ball test. Data were obtained on various polyethylene films by means of a modified Izod impact tester. Among the variables studied were film thickness, melt index, methods of molding, use of microcrystalline wax additives, specimen direction, and kraft paper substrates. The conclusions reached indicate that tensile-impact data are usually more accurate than those obtained by the bag-drop test.

NOL ring test for glass roving-reinforced plastic. P. W. Erickson, Sr., I. Silver, and H. A. Perry, Jr. Plastics Tech. *4*, 1017-24 (Nov. 1958). A new method for testing plastics reinforced with parallel glass fibers is described. Test **(To page 204)**

Notice

Rand Development Corporation is currently marketing and licensing others to use certain apparatus known as the Rand Fiber-Resin Depositor or Rand Gun, and a method for producing reinforced plastic laminates under United States Patent No. 2,787,314 granted to David F. Anderson and owned by Canadian Ingersoll-Rand Company, Ltd. Rand Development Corporation has exclusive rights to the patented apparatus and method in the United States, Canada and other countries.

It is the general policy of Rand Development Corporation to grant sub-licenses under the patent in a wide variety of fields to responsible individuals, firms and corporations.

To protect such sublicensees, as well as the substantial investment in the development and improvement of the apparatus and method, it is also the considered policy of both Canadian Ingersoll-Rand Company, Ltd. and Rand Development Corporation to see that the Anderson patent is respected. In furtherance of this policy, suits have been instituted in the appropriate United States District Courts against two companies which it is believed are infringing the patent.

- **Canadian Ingersoll-Rand Company, Ltd.** MONTREAL, CANADA
- **Rand Development Corporation** CLEVELAND, OHIO

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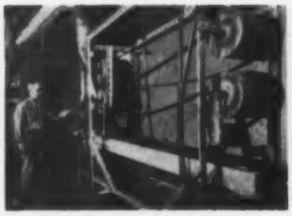
VIC PACKAGED WATER OR AIR-COOLED CHILLERS

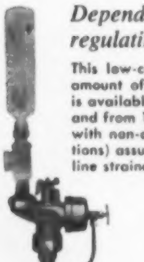


CUSTOMER'S OPINION: "Our Vic air-cooled chiller cut production costs, and completely solved our drainage problems . . . adding new efficiency to our operation," states Mr. B. Rosenberg, Vice President of Poly-Cell Plastics Co.

CUSTOMER'S OPINION: "Our Vic chiller has eliminated 'down-time' due to insufficient cold water," reports Mr. Richard Wesley, Vice President of Cello-Vision Corp. "It has reduced spoilage and cut our water bills to a fraction of former costs," adds Mr. Wesley.

Now you can get more production in less time from your existing equipment by simply adding a completely self-contained VIC packaged air or water-cooled chiller. Perfect for cooling injection molding, embossing, extrusion and laminating equipment—provides positive temperature control of any liquid to within 3 degrees! You can eliminate sewage problems and cut water costs, too—if you use well or city water for machine or liquid cooling in your plant. Vic chillers completely eliminate these problems because they utilize a closed system which re-circulates and re-uses the same water. If you use well water, you save the costly expense of future drilling and additional pumping equipment—or if you use city water, a Vic chiller will free your plant from restrictive city water codes. Whether you use air or water cooling—a Vic chiller will help you increase production—cut your costs!

Completely self-contained, Vic chillers are low in cost, inexpensive to operate, and easy to install—and the average unit requires only 15 sq. ft. of floor space. Available in five sizes up to 10 ton to meet most cooling requirements, and units may be easily adapted or modified to meet your special requirements.



Dependable, positive-action water temperature regulating valve costs less than $40!

This low-cost unit cuts water costs by supplying only the exact amount of water required for your particular application. Valve is available in two temperature ranges: adjustable from 60°-120°, and from 100°-160°—accurate to within 2°. Constructed throughout with non-corrosive materials—simple design (no electrical connections) assures dependable, trouble-free operation. Valve, including line strainer and thermometer, costs less than $40.

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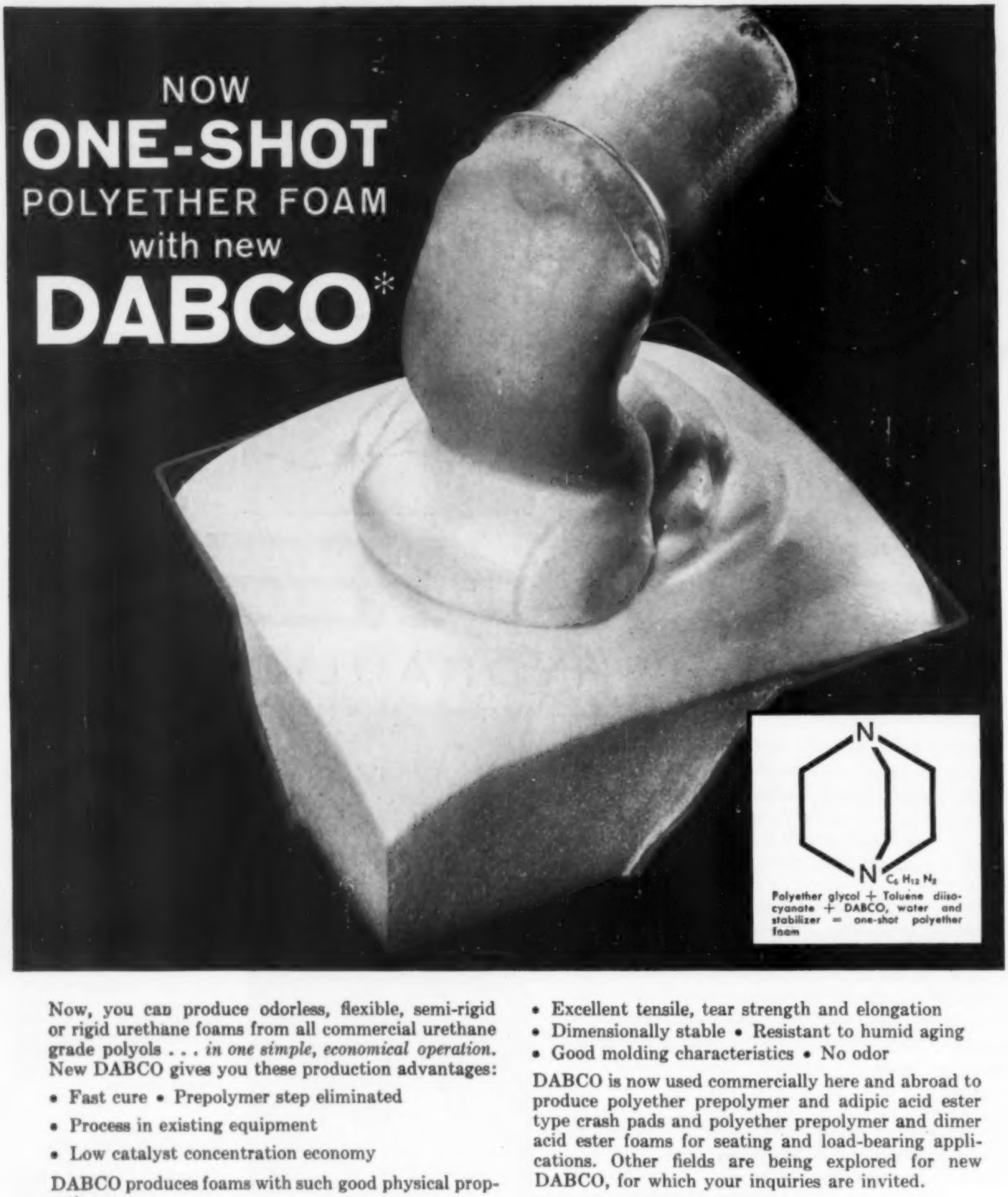

Now, you can produce odorless, flexible, semi-rigid or rigid urethane foams from all commercial urethane grade polyols . . . *in one simple, economical operation.* New DABCO gives you these production advantages:

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DABCO produces foams with such good physical properties as:

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The structure and properties of DABCO suggest the following other possible areas of interest:

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DABCO is now used commercially here and abroad to produce polyether prepolymer and adipic acid ester type crash pads and polyether prepolymer and dimer acid ester foams for seating and load-bearing applications. Other fields are being explored for new DABCO, for which your inquiries are invited.

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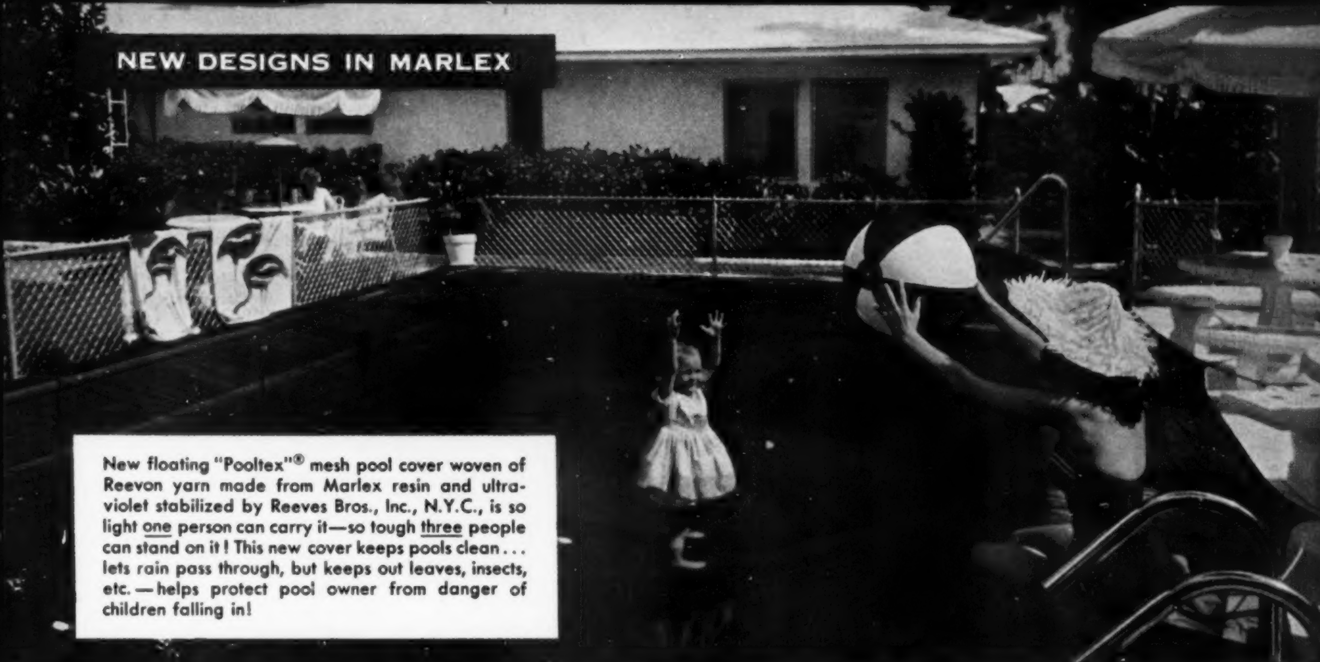

New floating "Pooltex"® mesh pool cover woven of Reevon yarn made from Marlex resin and ultra-violet stabilized by Reeves Bros., Inc., N.Y.C., is so light one person can carry it—so tough three people can stand on it! This new cover keeps pools clean . . . lets rain pass through, but keeps out leaves, insects, etc. — helps protect pool owner from danger of children falling in!

Get in the swim—with water sports products made of MARLEX*. . . the tough, rot-proof, floating plastic!

Cash in on profitable water sports markets with new idea products made of MARLEX, the linear polyethylene that is so strong and tough it can be used for tugboat hawsers, yet so light it actually floats.

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In fact, no other type of material can serve so well and so economically in so many different applications. How can MARLEX serve you?

*MARLEX is a trademark for Phillips family of olefin polymers.

Sinko Mfg. & Tool Co., Chicago, Ill., offers this new "Sea Guard" battery case that is impervious to acids, salt air and water. This new unbreakable case made of MARLEX withstands both high and low temperatures . . . holds all standard 6- and 12-volt marine batteries.

Fishing tackle boxes injection-molded from MARLEX by Plano Molding Co., Plano, Ill., are lightweight, rugged and corrosion-proof. These unbreakable tackle boxes will not crack or dent, and are completely weather-proof. Their attractive finish is durable and scratch-resistant.

Many leading manufacturers offer rope made of MARLEX to the marine market for ski tow ropes, hawsers, shrouds, life lines, heaving lines and general usage. Unbreakable, unsinkable rot-proof handles for ski tow ropes are molded from MARLEX by Lock-Hauer Co., Portland, Ore.

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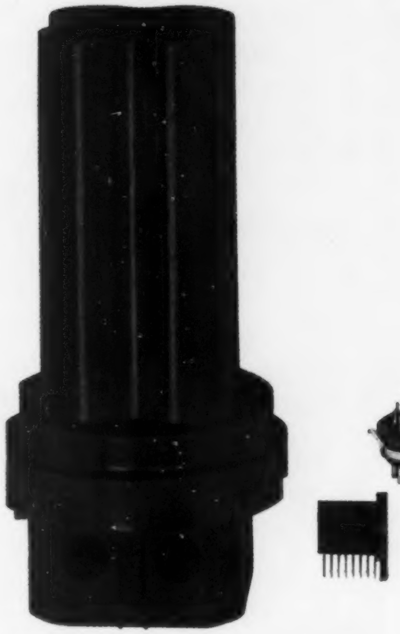
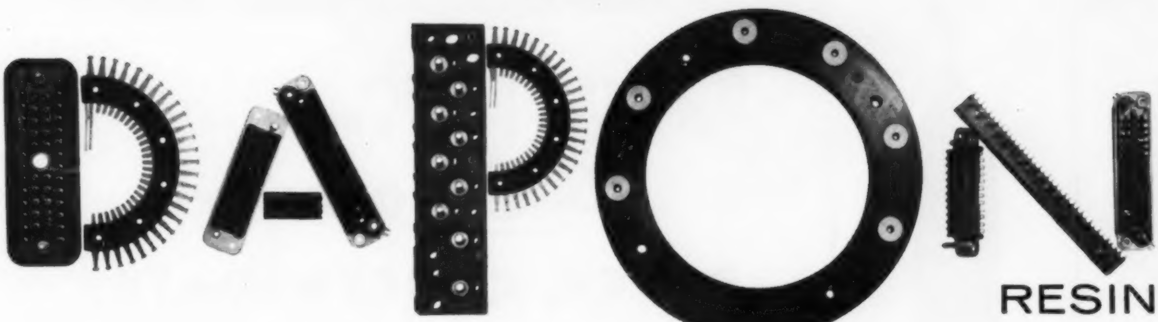


DAPON® (DIALLYL PHTHALATE) RESIN FOR SUPERIOR ELECTRICALS



RESIN

DAPON® resin (diallyl phthalate prepolymer), a preferred and frequently the only acceptable material in military and space technology applications, is equally well suited to a wide range of industrial uses. Molded DAPON resin parts are widely used today by the leading companies in the electronics industry.

Electrical parts molded with DAPON resin are unexcelled for retention of dielectric strength, insulation resistance and arc resistance even under conditions of high humidity and elevated temperatures. DAPON resin's unusual stability eliminates breakdown and attendant corrosion of metallic electronic components. And the exceptional dimensional stability of DAPON resin permits molding of complex parts with multiple inserts as well as close tolerances without machining. For use at higher temperatures another form of DAPON, named DAPON M resin (diallyl isophthalate prepolymer), is also available.

FMC manufactures the basic DAPON resin only and does not supply finished molding compounds. DAPON resin molding compounds are available from:

ACME RESIN CORPORATION 1401 Circle Avenue Forest Park, Illinois	as	Acme Diallyl Phthalate Molding Compounds
DUREZ PLASTICS DIVISION Hooker Chemical Corp. North Tonawanda, N. Y.	as	Durez Diallyl Phthalate Molding Compounds
MESA PLASTICS COMPANY 11751 Mississippi Avenue Los Angeles, California	as and	Diall® (Diallyl Phthalate) Molding Compounds Diall® (Diallyl Isophthalate) Molding Compounds
ROGERS CORPORATION Rogers, Connecticut	as	Rogers Diallyl Phthalate Molding Compounds

For complete information about DAPON resin's outstanding electrical properties and how it can help solve your problems, write to FMC Chemicals and Plastics Division.

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Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION

Chemicals and Plastics Division

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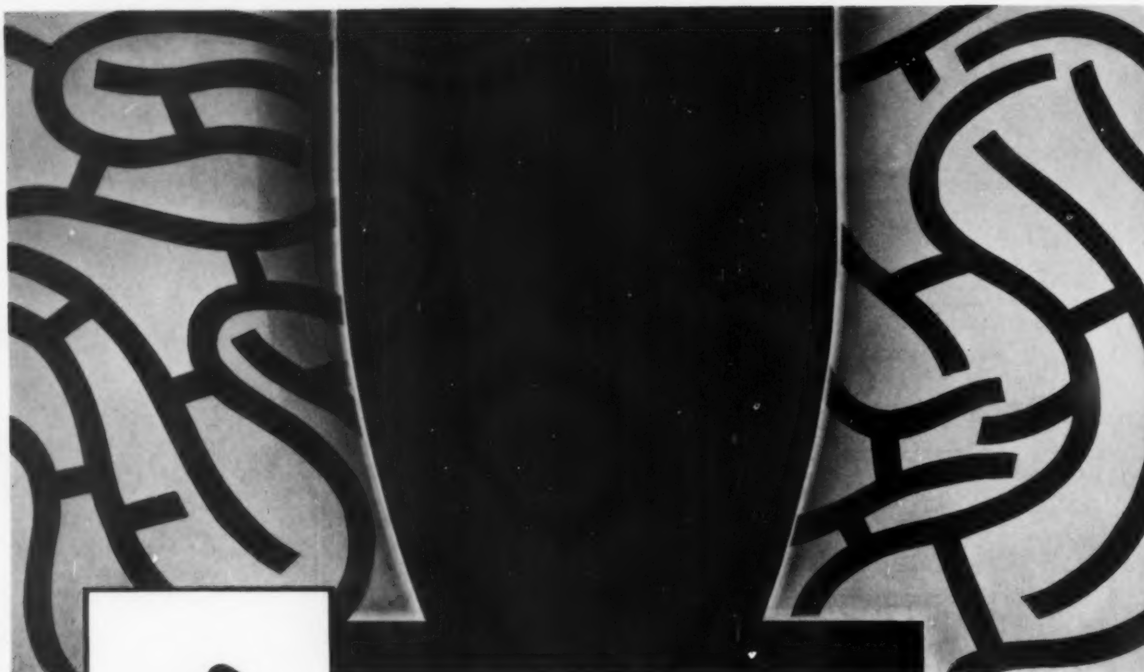

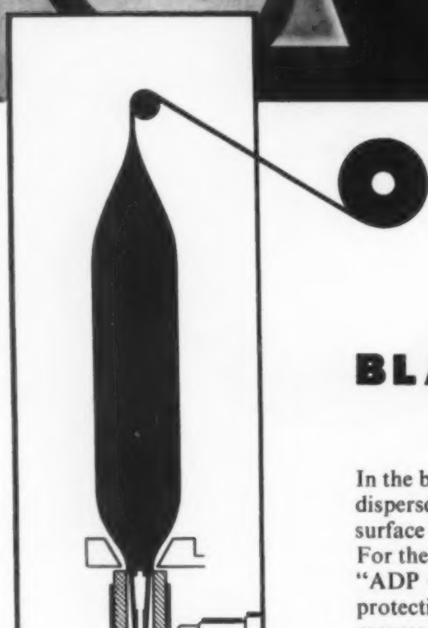

UNIFORM BLACK FROM DIE TO WINDUP

"adp QUALITY"

BLACK CONCENTRATES

MAKE THE DIFFERENCE!

In the blown-film extrusion of thermoplastic resins, only *completely* dispersed carbon black can assure the uniform jetness and smooth surface texture required to meet top product quality standards. For the manufacture of agricultural film and sheeting, for example, "ADP Quality" black Polyethylene concentrates give a degree of protection against deterioration from ultra violet sun rays that assures maximum serviceability under the most extreme exposure conditions.

"ADP Quality" carbon black dispersions in Polyethylene, PVC and Polystyrene resins permit equally superior coloration of plastic pipe, filament and flat-film extrusions.

ADP concentrates of black and all standard colors are supplied in dry granular dispersions for ease of handling. Ultra-fine dispersion of pigment particles provides *extra tint strength* for color-stretching economy. Send for samples to meet your specified requirements . . . or let ADP specialists work with you to solve your coloring problems. 900

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ACHESON DISPERSED PIGMENTS CO.

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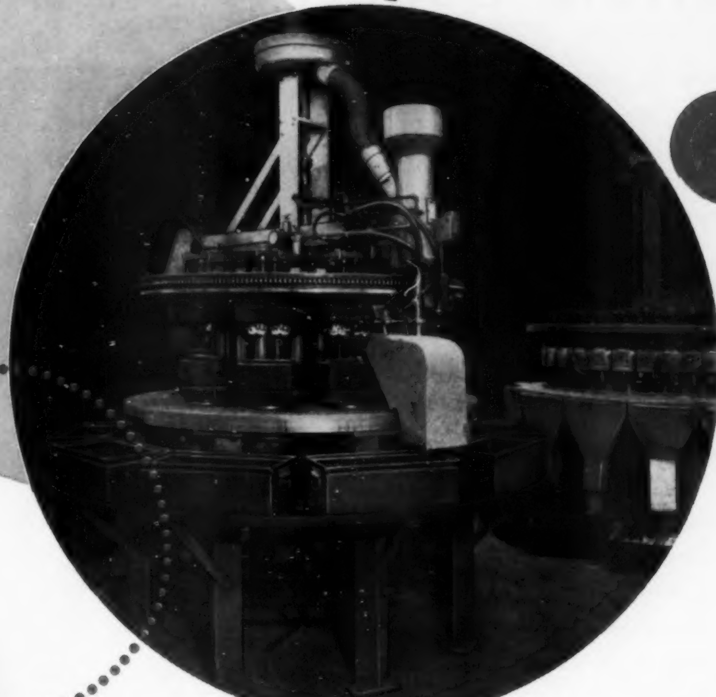
In Europe: Acheson Industries (Europe) Ltd. & Affiliates, 1 Finsbury Square, London, E. C. 2, England

QUALITY DISPERSIONS MEAN QUALITY PRODUCTS



AUTOMATIC ROTARY PLASTIC MOLDING PRESSES

10- or 30-Station Machines

- Low cost simple molds
- Machine easily installed
- Simple ejection of parts
- Easily maintained
- Maximum flexibility
- Fully automatic compression molding
- Hopper feed – the supply rotates
- Adjustable production cycle
- Adjustable temperature in mold holders
- Low cost molding for small quantities
- Molds changed without production interruption

For descriptive bulletin or opportunity to see these machines in operation, contact

NEW ENGLAND BUTT CO.

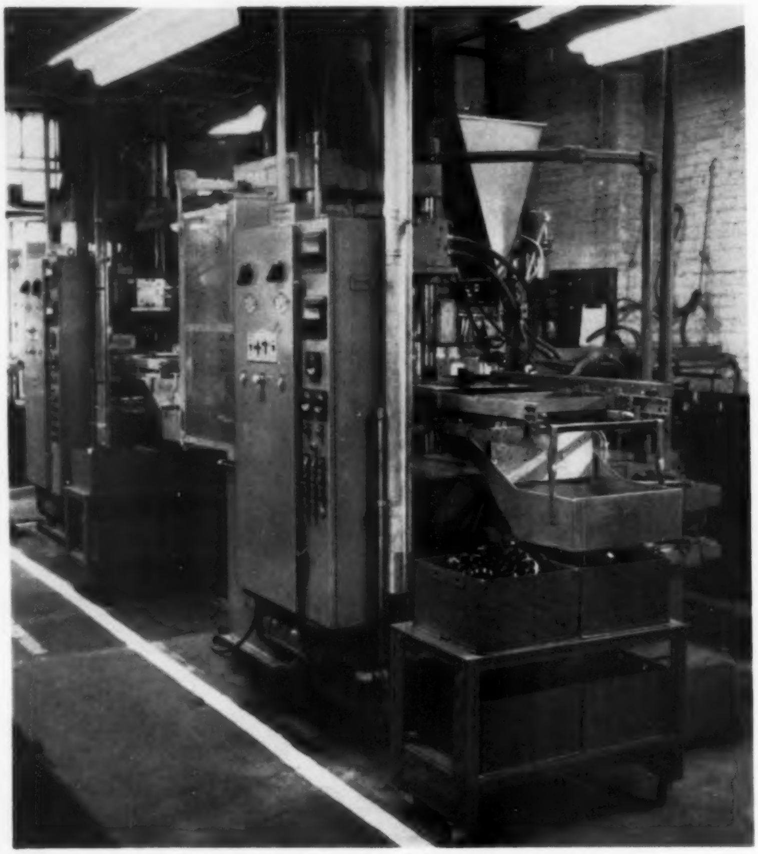
Division of Wanskuck Co.

304 Pearl Street • Providence 7, R. I.

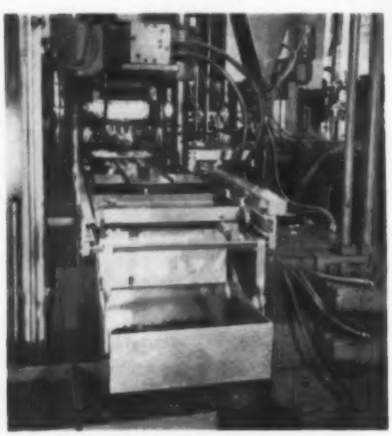
PROBLEM: Unconventional parts
SOLUTION: Baker!

"We decided on the Baker Automatic Plastic Molding Press as the one truly flexible machine that could be readily adapted to the specialized parts we had in mind," reports William E. Exner, engineer in charge of rubber and plastics at The Pyle-National Company, Chicago, Illinois.

This electrical manufacturer uses Baker presses for producing their PYLE-STAR-LINE electrical connectors. A minimum reject rate has resulted from the automatic and accurate control of such variables as temperature, time, instantly adjustable cycles and metering of compound. The quickly adjustable Baker material metering system and the fast mold setup time are extremely important to this company, which often has short production runs of two or three 24-hour days.



Baker Plastic Presses in operation at The Pyle-National Company, Chicago



Operator adjusting a new mold. All molds designed to minimize flash.

Set-up time is down 50%

With Baker presses, mold changing is a fast one-man job. Mr. Exner also says, "We had excellent engineering assistance from the Baker people," in solving special problems.

Complete, illustrated information and engineering advice on your plastic molding problems are available by writing to BAKER BROTHERS, INC., DEPT. OP-559, 1000 POST STREET, TOLEDO 10, OHIO.

BAKER®

COMPRESSION MOLDING MACHINES

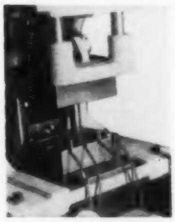
STANDARD AND SPECIAL DRILLING AND TAPPING MACHINES • AUTOMATIC BAR MACHINES • SPECIAL MACHINE TOOLS

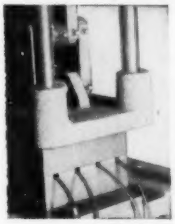
For profitable plastic injection molding of parts involving inserts or loose cores . . . the

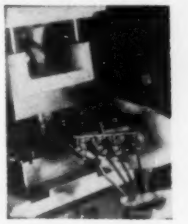
"Eldorado" MINI-JECTOR®

Reg. U.S. Pat. Off.

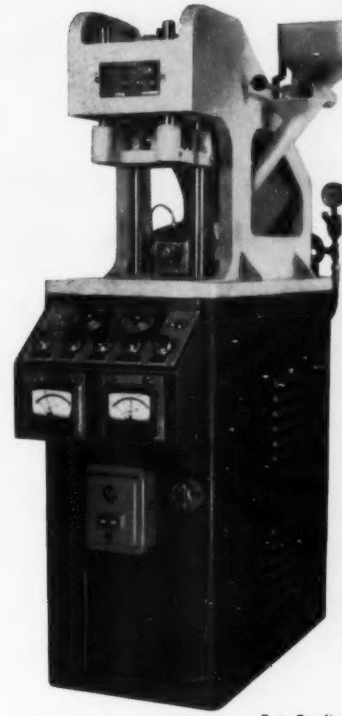
Plastic Injection Molding Machines





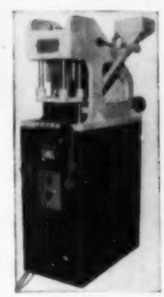


Typical example of insert molding on "Eldorado" MINI-JECTOR. *Left*—Close up of mold in open position. Note unobstructed access to mold area. *Center*—Close up of mold in closed position. *Right*—Cycle completed. Molding of cord endings shown represents only one of hundreds of applications, but as they are familiar objects, it is easy to visualize the capacity range of "Eldorados."



Pat. Pending

Super "Eldorado" MINI-JECTOR, model 70VC105 (above) offers semi-automatic operation with push button controls in addition to all the advantages of the Standard "Eldorado", model 70VC95 (right) which is lever controlled.

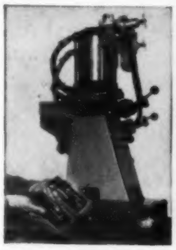


"Eldorado" MINI-JECTORS are designed to solve a specific injection molding problem. They are the ideal answer to *fast, low-cost* production of small parts (1/3 oz. to 1-1/2 oz.) around inserts or loose cores. "Eldorado" MINI-JECTORS are daily molding a wide variety of precision parts in all thermoplastics.

The "Eldorado" MINI-JECTOR is hydraulically operated and is available either with lever controls or for semi-automatic operation.

"BUILD" YOUR OWN MINI-JECTOR!

What kind of a small injection molding machine do you want *exactly?* In the Mini-jector you not only have your choice of 9 stock models but in addition there are over 50 combinations of *stock* options! All these are at low production prices because we specialize in the production of machines in the range of 1/3 to 1-1/2 ounce capacity with psi on material up to 30,000 lbs. You can have machines powered by hydraulic or air, using small self-clamping "V" molds or conventional molds which bolt to platens and may be horizontal or vertical in operation. You have your choice of lever controls, semi-automatic or even completely automatic models. The list of low cost options is astonishing. But what it means is that YOU can virtually design your own Mini-jector, tailored precisely to your needs!



Two of the 9 stock MINI-JECTOR models. *Left*—"Wasp," with air or hydraulic power provides capacity of 1/3 oz. to 1 oz. Uses small "V" molds. *Right*—"Hornet" MINI-JECTOR has horizontal clamping and mold area of 6" x 5⅛" x 5". Molding capacity up to 1 oz.

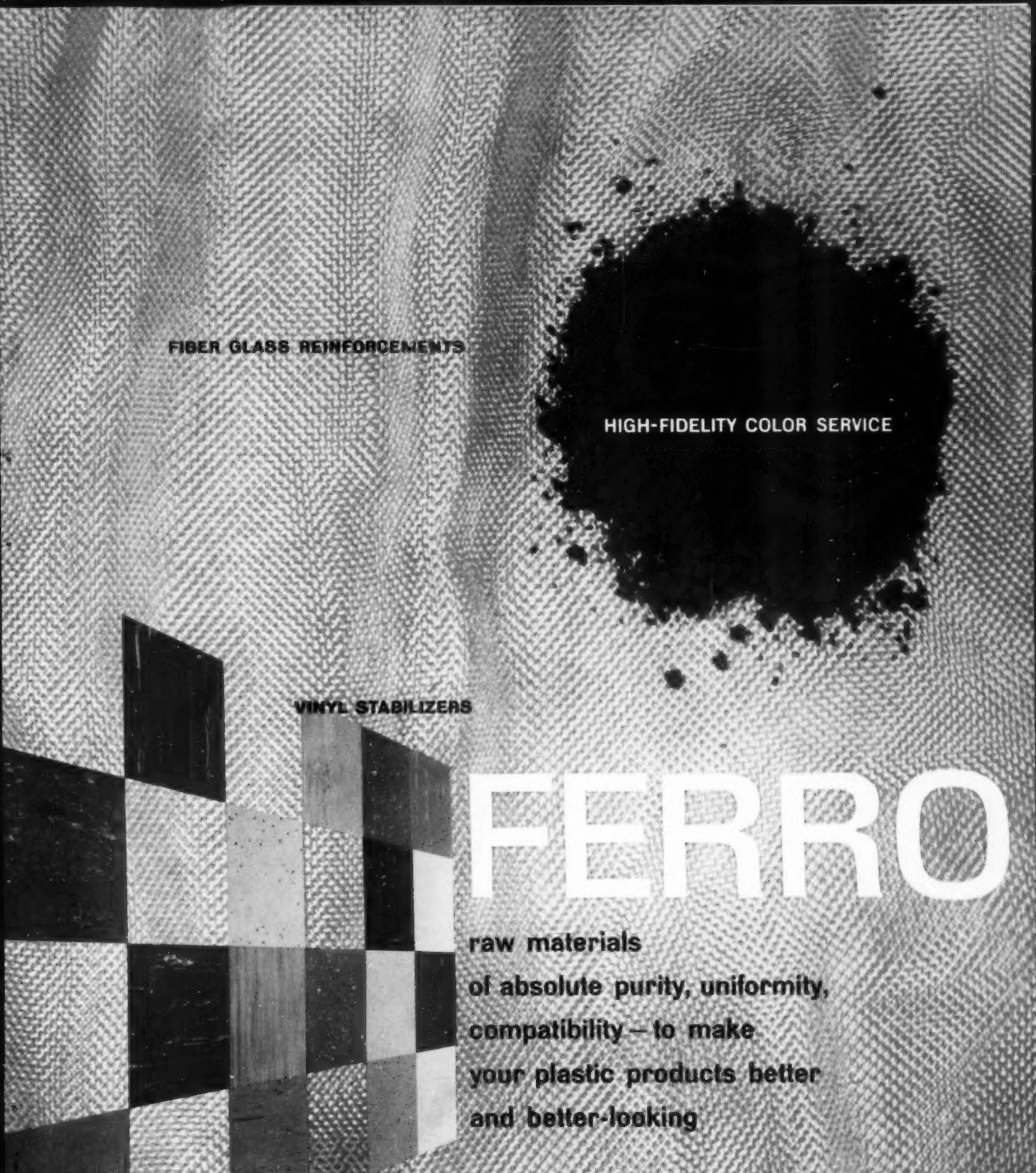
You'll like these outstanding "Eldorado" features:

- ***No front tie rods*** **to hinder operator's easy access to mold area when mold is open.**
- ***Vertical Clamp Operation*****—Inserts or loose cores remain undisturbed because bottom of mold is always stationary.**
- ***Simple to Operate*****—No special skill needed for efficient operation.**
- ***Hydraulic Power*****—Self-contained Vickers hydraulic system powers mold closing and injection.**

Write for FREE catalog—Detailed, illustrated, complete. Engineering data and specifications on all MINI-JECTOR models and accessories. Quotes prices. Shows how MINI-JECTORS can cut your major injection molding costs.

NEWBURY INDUSTRIES, INC.

Box 41, Newbury, Ohio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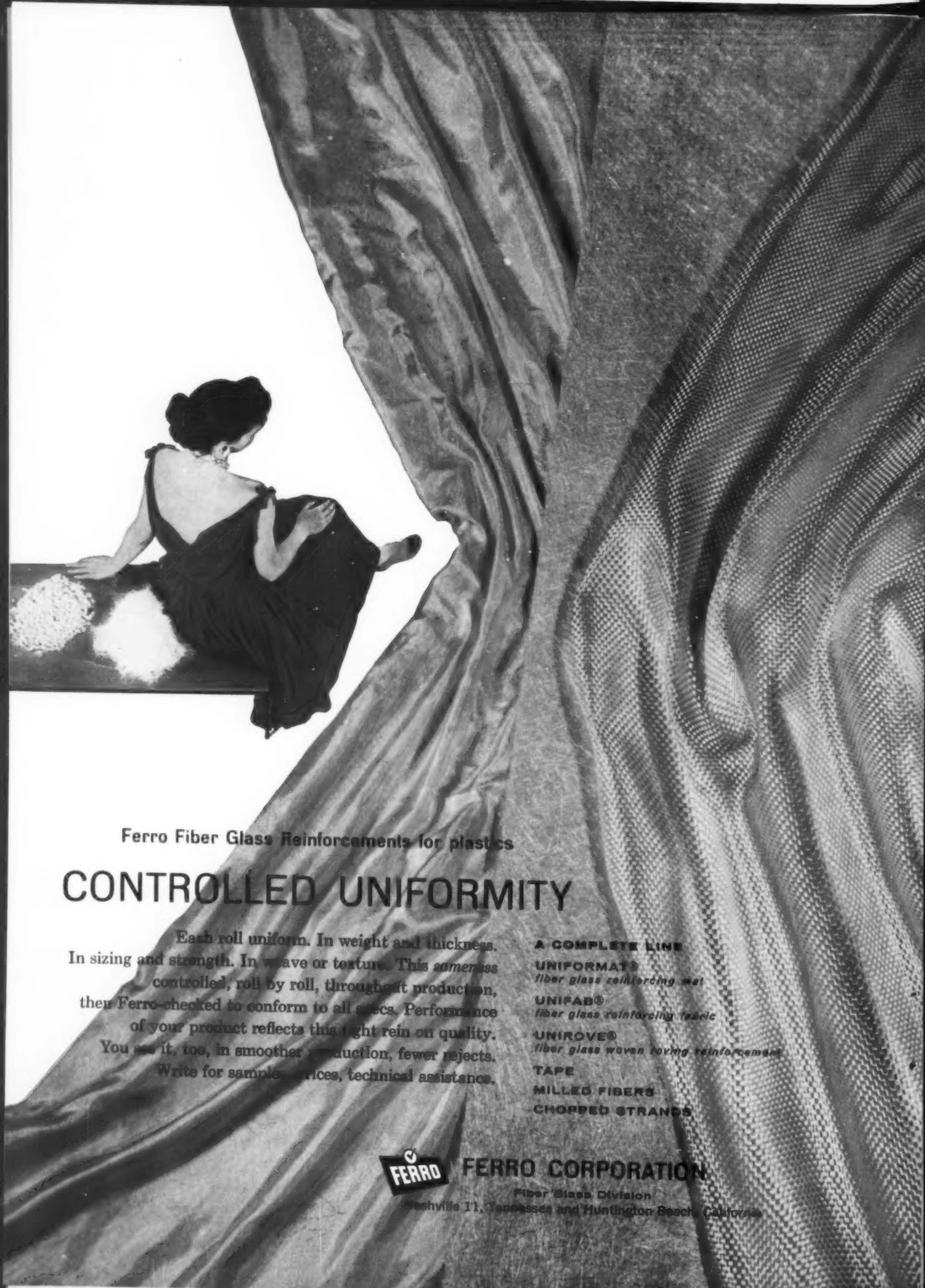
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fiber glass reinforcing mat
UNIFAB®
fiber glass reinforcing fabric
UNIROVE®
fiber glass woven roving reinforcement
TAPE
MILLED FIBERS
CHOPPED STRANDS
FERRO
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STABILITY in VINYLS
Efficient production of top-quality vinyls often is a direct reflection upon the stabilizers you use. When you use the right stabilizer, your vinyl products *behave* during processing. Your production flows more smoothly. And your products endure in actual use, so that customers stay sold.
Ferro's technical service department will gladly work with you. Knowing that your processing conditions and special requirements are important factors, we tailor Ferro Stabilizers exactly to your needs. That's why Ferro Stabilizers, from our complete line, will do the job you want to do.
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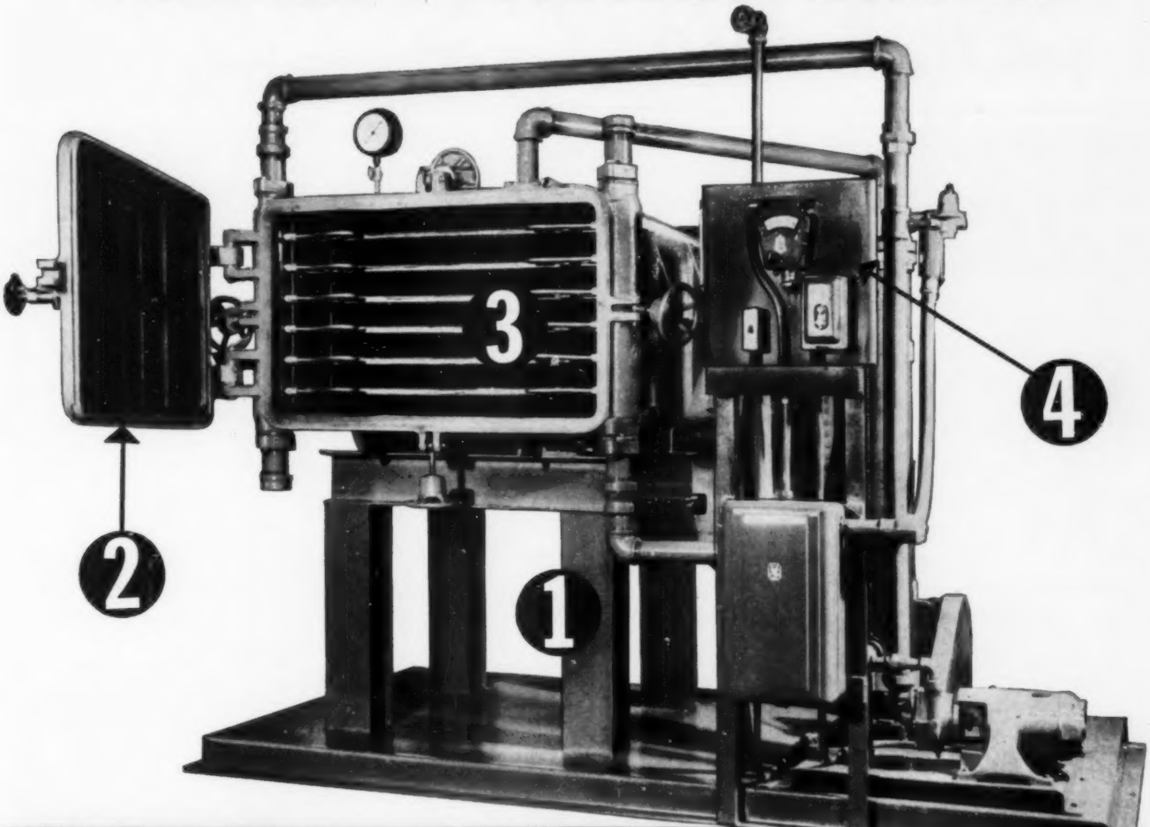
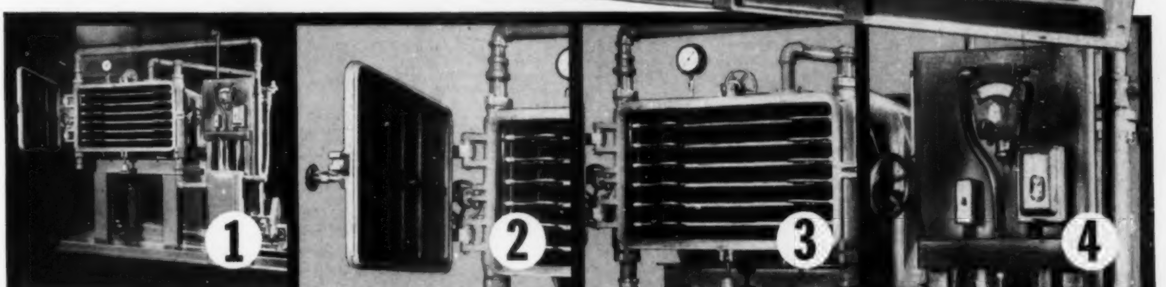
DEVINE PLASTICS DRYER





A COMPLETE UNIT with vacuum pump, condenser, piping and hot water heating system.

HEAVY DUTY CONSTRUCTION Door is equipped with parabolic dove-tailed rubber gasket.

CONTROLLED HEAT Trays rest on heating platens uniformly distributing heat.

COMPLETE CONTROL Centralized control panel places operator in complete control.

Saves drying time — — cuts costs

The Devine Standard Vacuum Chamber Dryer, the result of 50 years' experience in the process equipment field, offers a fast, inexpensive, safe drying method for all plastics, virgin or scrap.

The "Devine Method" of low temperature vacuum drying means safe drying for heat-sensitive plastics, removes danger of discoloration. Another advantage: overnight storage–dried material is kept under vacuum, can be used next day without redrying.

The Devine Dryer is a complete unit, wired and piped and equipped with its own platform, needs only water and power line connection for installation.

Devine Dryers are available in standard sizes from 2 to 846 sq. ft. effective pan surface or produced in a size to meet your needs. Write for complete details on Plastics Dryers and other products for the Plastics Industry such as ribbon mixers for plasticizing, conical-blenders, and roll mills, or for answers to your specific problems.

J. P. DEVINE MFG. CO.

101 49th Street & A.V.R.R.
Pittsburgh 1, Pa.

Export office: 50 Church St., New York 7, N. Y. *Cable address:* "Brosites" *New York office:* 500 Fifth Avenue, New York 36, N. Y. *Phone:* WIsconsin 7-7769

these thermatic Series* extruder features mean higher production on every job!

Simplified one piece cylinder with integrally cast-in Xalloy liner.

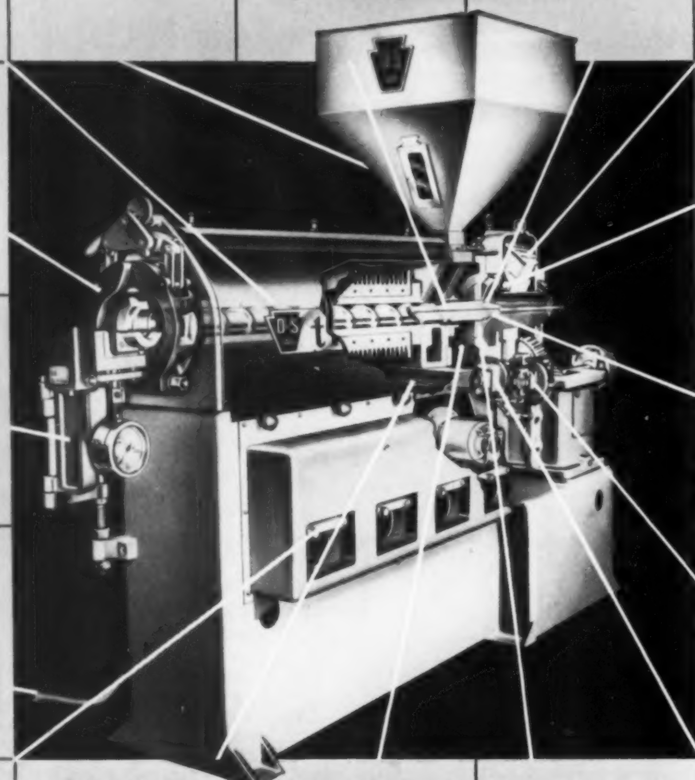
Extra large capacity stainless steel hoppers.

Screw flight extends back beyond the feed throat opening for improved powder and granule feeding.

Four-spline screw drive eliminates the eccentric screw rotation of a single key drive.

Helical gearing — smooth, efficient, free-running. Greatly increased horse-power capacity.

New stronger head clamp. Simplified opening and closing of head with positive safety shear pin arrangement.



Higher thrust bearing capacity. Extra-heavy separate thrust and radial bearings handle their respective loads individually to meet constantly increasing production requirements.

Improved hinged head support swings completely clear of the front of the extruder.

Tapered drive end of stock screw positively centers screw and simplifies removal.

Heaters and controllers completely wired for fast inexpensive installation.

Gear type oil pump, positively driven from input shaft, lubricates all bearings and gears regardless of speed.

Damper arrangement provides several gradients of natural draft cooling. Blowers provide high circulation for stubborn cooling jobs.

Air-tight oven effect adjustment by new second set of dampers for high temperature extrusion.

Access opening allows easy replacement of bronze feed throat bushing.

Labyrinth oil seals — simple non-wearing design. No oil seals or rings to replace.

Built-in direct drive stock screw electric tachometer.

Greater cylinder lengths standard on all extruder sizes with optional L/D ratios available. **2½", 3½", 4½", 6" and 8" models available.** The New D-S thermatic Series Extruders will outproduce — size for size — any other extruder on the market today. For complete specifications and details write to:

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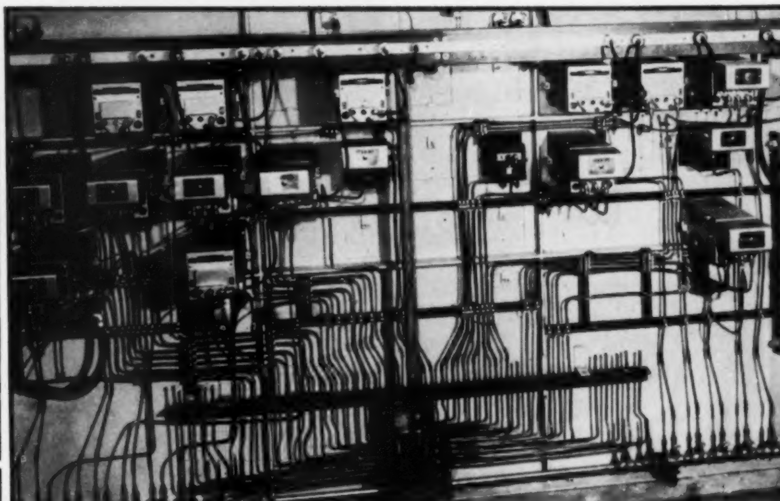
Plaskon Nylon News

A round-up of recent happenings in type-6 nylon, including new applications... and some economics for extruders to ponder.

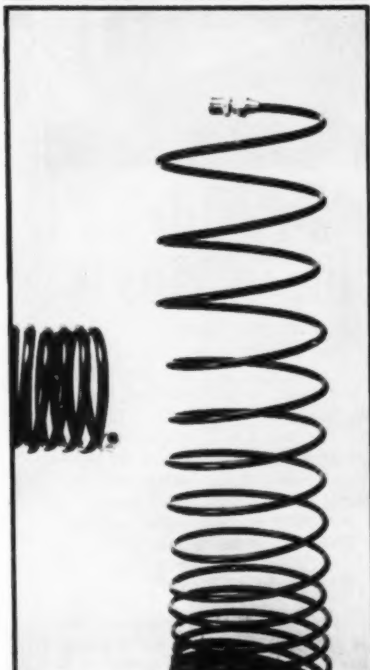
ECONOMY IN EXTRUSIONS

The question, "Is the scrap re-usable?" can make or break the profit picture of any extruding operation. PLASKON Nylon Extrusion Compound 8205 maintains high-melt viscosity through successive regrinds. Scrap can be re-extruded several times without loss of basic properties. This scrap re-use often gives a sharp competitive advantage to users of PLASKON 8205.



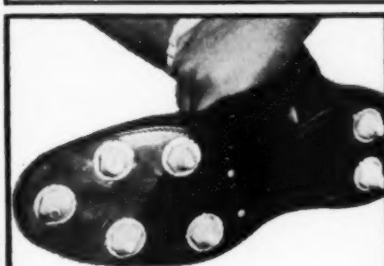
INSTRUMENTATION

Color-coded nylon tubing replaces copper in control panel at Allied Chemical's phthalonitrile plant, Edgewater, N. J. Nylon's advantages: 50% less in cost, greater corrosion resistance, easily color-coded.



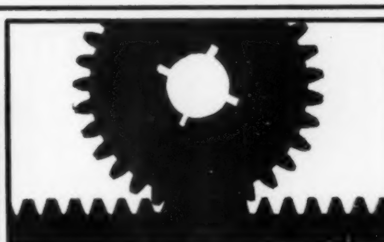
TOUGH AIR HOSE

For use with pneumatic tools, this lightweight "Nycoil" hose is extruded from PLASKON Nylon. It's tough, heat-resistant, unaffected by hydrocarbons . . . has permanent recoil action.



FOOTBALL CLEATS

Molded of PLASKON Nylon, these cleats outwear other types by a factor of 5 to 10. Their safety and durability suggest other possible applications in sports equipment.



GEAR AND RACK

Type-6 nylon has higher impact resistance than other nylons. This advantage goes to work in a gear and rack molded of PLASKON Nylon and used in Scott Company lawnmowers. The parts are more durable than the metal ones they replace.

For further information, or technical assistance, write to our Nylon Product Development Department.

PLASTICS AND COAL CHEMICALS DIVISION
40 Rector Street, New York 6, N. Y.

Allied Chemical

Count on Invin® 91 stabilizer to provide crystal clarity, lasting non-yellowing in vinyls

Count on 4 important stabilizing actions from Invin 91 stabilizer, versatile liquid barium-cadmium stabilizer for clear, filled and colored vinyl stocks.

1. **Outstanding crystal clarity** — in calendered and extruded products.
2. **Unique inhibition of yellowing** — in processing, in service.
3. **Exceptional heat stability** — ample for modern high-heat, high-speed processing.
4. **Powerful light stabilizing action** — in severe outdoor and auto upholstery service.

Invin 91 stabilizer aids formulating, too

Count on Invin 91 stabilizer for two formulating benefits:

(1) Compatibility with *all* of the commonly used plasticizers – the organic ester types, the more sensitive phosphates, organic epoxides, ether esters, polyesters and hydrocarbons. Special plasticizer combinations, too, pose no serious problems.

(2) Wide choice of lubricants in addition to stearic acid . . . without regard to effect on heat stability.

Count also on minimum plate-out . . . even under difficult conditions.

National Lead Research has developed outstanding stabilizers that meet specialized problems in *all* vinyl stocks made today . . . such as high temperature service in electrical insulations; oxidation in outdoor products; color-changing impurities and temperatures in flooring; heat and light stability in plastisols, organosols. Each National Lead Company stabilizer simplifies processing, extends useful product life.

Ask us for suggested formulations and 4-page technical brochure on Invin 91 stabilizer. Ask, too, for our comprehensive 12-page catalogue of vinyl stabilizers and gelling agents.

A Chemical Development of **National Lead Company**

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Fabricon offers the largest single line of RESIN IMPREGNATED PAPERS ever produced FOR MELAMINE DECORATIVE LAMINATES

Hundreds of patterns . . . wood grains . . . solid colors

Fabricon's multitude of designs gives you the freedom to select exactly the one you want, whether it's a contemporary or classical pattern—a rich-looking wood grain reproduction—or a lustrous solid color.

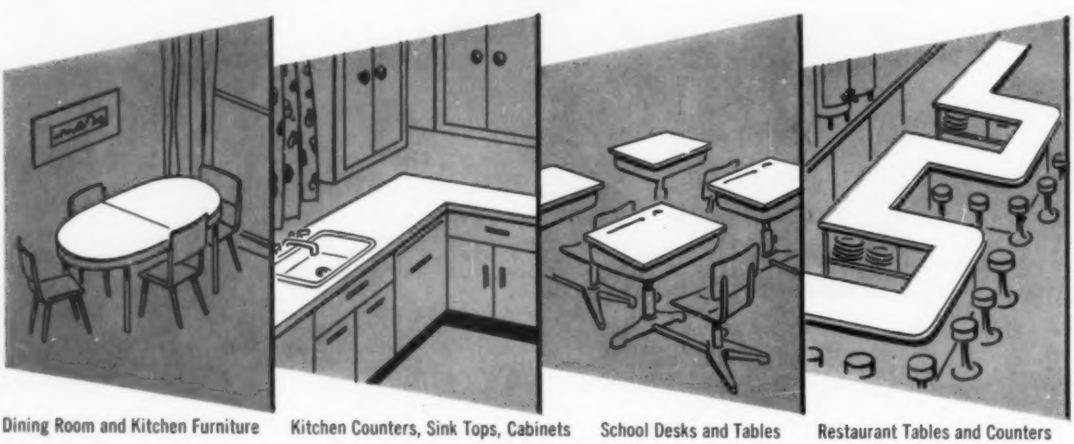
Fabricon also gives you a fine variety of clear or tinted overlay papers for hard protective surfaces—core stocks for multi-layer paper laminates or simultaneously assembled particle board products—and balancing papers for uses where balanced laminates are called for.

All Fabricon impregnated papers are custom treated to exact specifications based on predetermined laminating conditions. And when properly cured, Fabricon papers form tough, permanent decorative laminates that either meet or exceed standards of the National Electrical Manufacturers Association.

Here are the specific features you get in a Fabricon paper-decorative laminate surface: 1. Attractiveness that should be seen to be appreciated. 2. Very high resistance to scratches, abrasion. 3. Imperviousness to most household chemicals. 4. Resistance to stains, heat, burns. 5. No discoloration, warpage, expansion. 6. A surface that can be cleaned quickly with only a damp cloth.

For specific details, write, outlining your application.

USES OF FABRICON MELAMINE IMPREGNATED PAPERS



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FABRICON PRODUCTS

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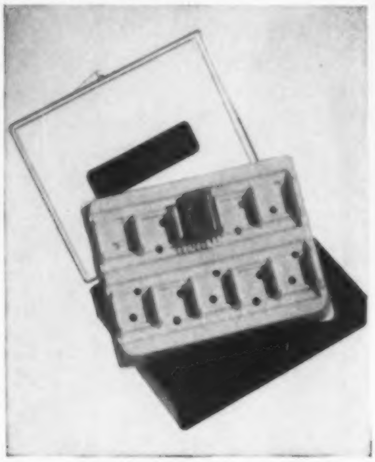
CAMPCO PROGRESS / *latest developments in plastic sheet • film • fabrication*

Campco Styrene Package
gives lock-in protection

Guardian Electric Company was looking for an attractive "shock resistant" package for a new line of miniature relays. Special protection was important because of tiny contact pins and varied shapes. A different package for each type would be costly and cause delay on the packing line.



Plastofilm Inc., of Wheaton, Illinois had the answer with a special formed insert of high impact Campco Styrene sheet. Although the relays have as many as ten different types of connectors, they fit snugly in identical compartments of the insert . . . with lock-in protection from shock.

How is this possible—well the compartments grip the relays by a combination of side walls, channels, grooves and holes. Each is capable of gripping any one of the relays in some way . . . providing ease of handling and filling in assembly and packaging.

Another feature is a see-through lid that allows instant recognition of printed codes on the relays. Packaging in plastic can pay off for you, too. Perhaps Campco Styrene is *your* answer.

One Reliable Source

Now you can fill all your requirements for packaging plastics from one reliable source. Campco now offers Polyethylene, Acetate, Butyrate, Styrenes, Polypropylene, Nylon — in sheets or rolls depending on gauge . . . cut to size if desired . . . clear or colored transparent . . . translucent or opaque. Rolls of clear film in stock for immediate shipment at cost savings.

Double-bubble blister of Campco Butyrate doubles market for small stapling machine

The Wilson-Jones Company wanted to expand its market for small stapling machines, currently being sold through the stationery store. It reasoned that if housewives were exposed to their product in self-service outlets, they'd find them useful for fastening jobs around the house. A package was needed that would be pilfer-proof, capable of delivering its own sales message, and interesting enough to create impulse buying.

Plastofilm Inc. of Wheaton, Illinois delivered the answer with a combination cardboard sheet and plastic blister of Campco Butyrate. The one-piece blister has two bubbles—one for holding the stapler and the other for 1000 staples. The 6x8 inch card is too large for the pocket and the blister designed so that it cannot be pulled away without destroying the card . . . making pilferage difficult. Impulse buyers are enticed by the see-through blister and sold by the printed message of the housewife doing basic fastening jobs.

Without increasing packaging costs, this new design in a very short time more than doubled sales.

Campco Butyrate is extremely strong and pliable. It can be deep formed, patterned and hole punched without shattering or cracking and is easy to decorate. Available in crystal clear or a variety of colors—rolls and sheets in thicknesses .005″ to .125″ stock or custom size.

Campco Acetate Sells
while it protects

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Packages by Plastofilm Inc., Wheaton, Ill.

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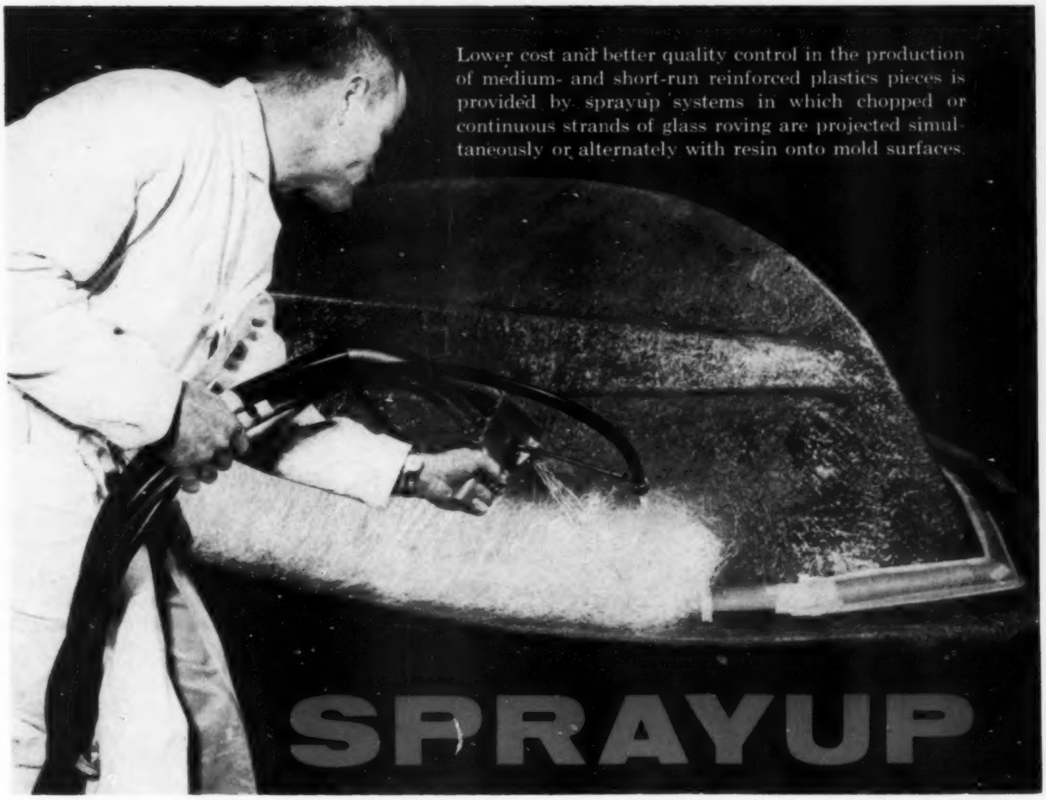
May 1959, Volume 36, Number 9

MODERN PLASTICS



Lower cost and better quality control in the production of medium- and short-run reinforced plastics pieces is provided by sprayup systems in which chopped or continuous strands of glass roving are projected simultaneously or alternately with resin onto mold surfaces.

–exciting economies for reinforced plastics

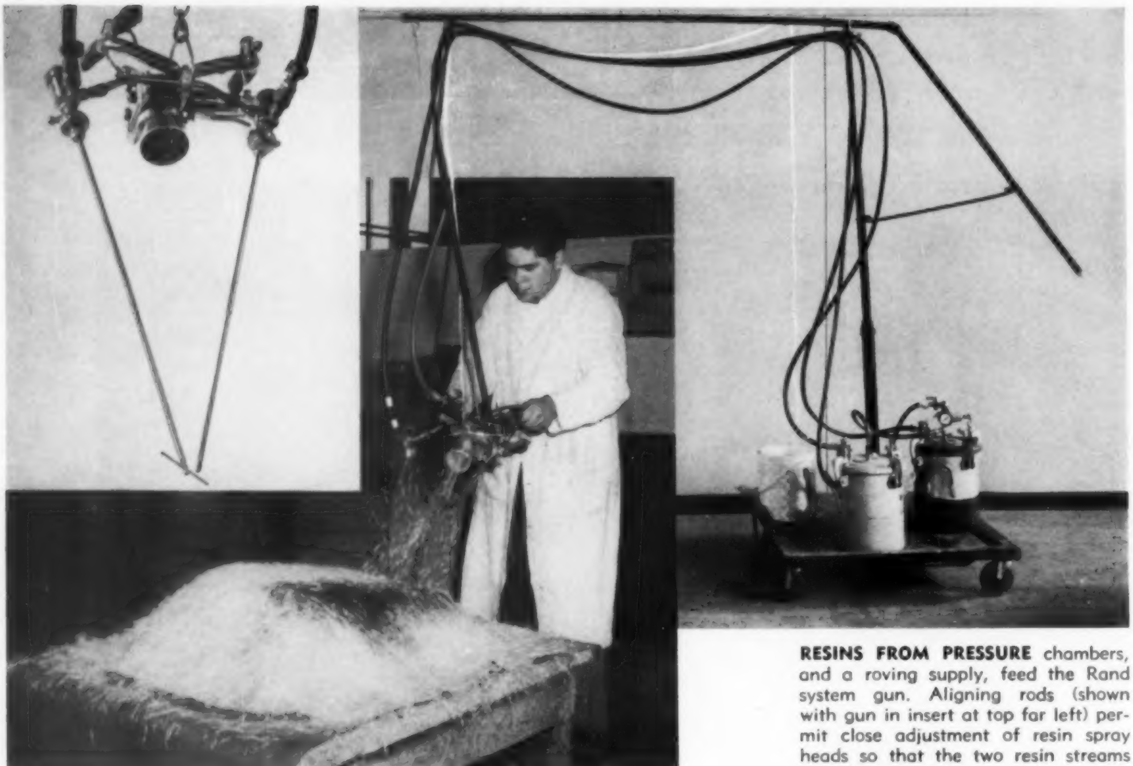
Intense interest is developing for a new tool of the reinforced plastics industry, particularly applicable to medium and short runs of large pieces—sprayup. Some of the claims: labor costs cut as much as 60%; savings up to 25% by waste reduction; higher glass content where greater strength is needed; faster production schedules; cleaner shops and better working conditions.

Basic to the process are a new group of guns which spray the resin mix—not to be confused with guns for paint, gel-coat, or preform spraying—and glass delivery "guns" which either chop (or break) glass roving or apply roving in continuous strands. The whole object is to get the glass onto the mold surface, to wet it thoroughly with catalyzed and promoted resin, and to do both jobs quickly and uniformly, with minimum loss of time and material.

What's already being done . . .

A few specific examples of actual production jobs point up the case for sprayup.

- At Larson Boat Co., Little Falls, Minn.,



SIMULTANEOUS APPLICATION of chopped glass with sprays of promoted and catalyzed polyester resins is exemplified by the Rand system, in which the operator guides the output of the sprayup gun over the mold surface. Continuous roving can also be used.

RESINS FROM PRESSURE chambers, and a roving supply, feed the Rand system gun. Aligning rods (shown with gun in insert at top far left) permit close adjustment of resin spray heads so that the two resin streams and the chopped glass will meet at the optimum convergence point. This assures maximum wetting of the glass with resin, as well as uniform deposition on the mold surface.

one of the popular models is a 19-ft. boat with a lap-lined bottom. The contours of this bottom made hand layup difficult and time-consuming. When made by hand, the hulls had to be produced in two pieces that were later joined together. Total time consumed for hand layup: 40 man-hours per hull. Sprayup time with a Rand gun (see below): 16 man-hours per hull, and each boat is made in one integral molding.

Using a 30%-glass laminate, the Larson hulls are reported to have ample strength to provide a more than adequate safety factor.

Larson is also pleased with the fact that the sprayup resin is bought in bulk, stored in underground tanks, and never need be handled: it is pumped directly from the tanks.

• Aeronautical Boat Shop, Inc., Copiague, L. I., N. Y., has a similar success story with the Rand gun. One 7-ft. dinghy sold for $218 when made by hand layup; now made by sprayup, it sells for $179 and the producer states that this 18% price reduction was made possible entirely by sprayup economies.

• In Norwalk, Conn., at the plant of Fiber Glass Products, truck roofs are being turned out at a rate of two a day, using a sprayup gun to produce the outer and inner skins of a sandwich having a foamed styrene core. These roofs are 18 ft. long, 7 ft. wide, and weigh 180 pounds. The metal roofs which they replace weighed 580 pounds. Cost to the fleet owner for the roofs is 5% less than the metal ones, but his biggest saving is the 400 lb. more payload that the lighter roof allows him to carry! Each skin is sprayed up in less than 1 hour.

. . . and what's in prospect

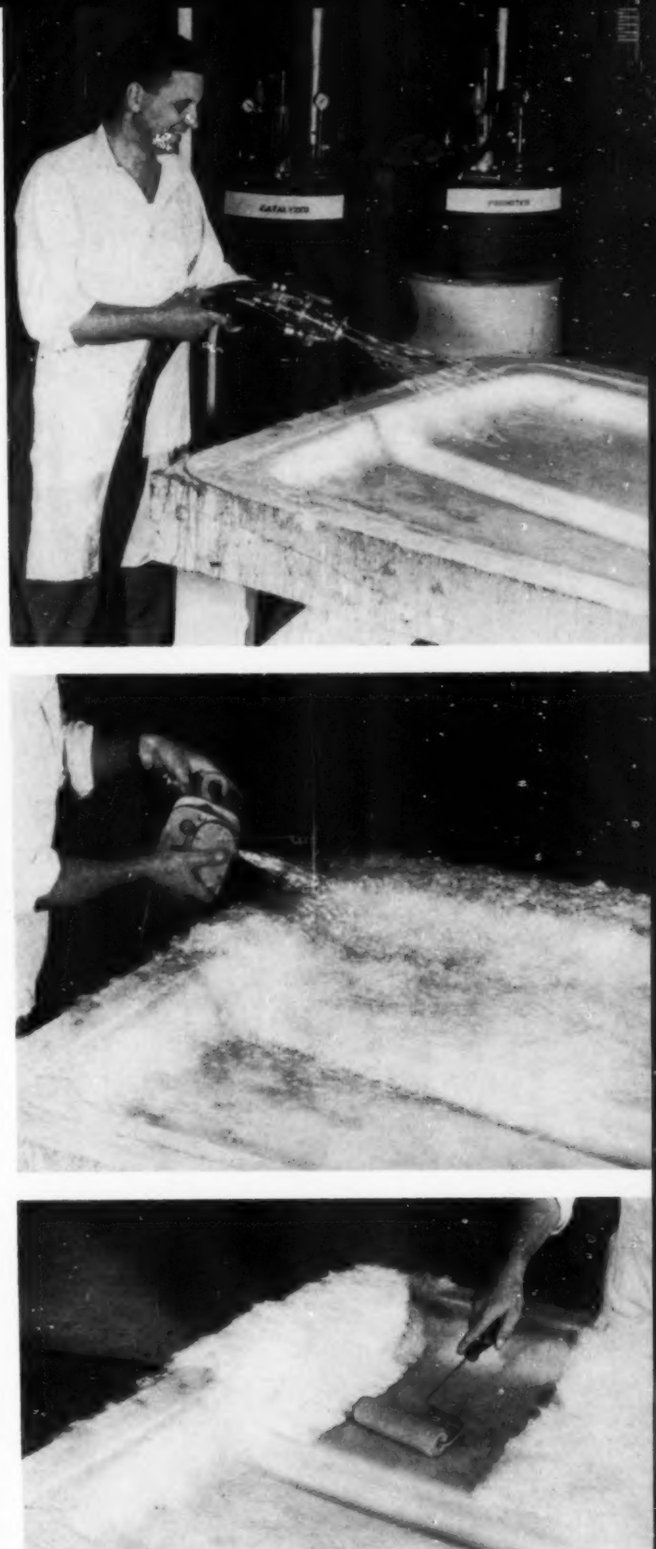
As exciting as the possibilities of sprayup operation are to contact and bag molders, the tremendous *new* markets opened up by the process are even more exciting.

Now, reinforced plastics can be applied al-

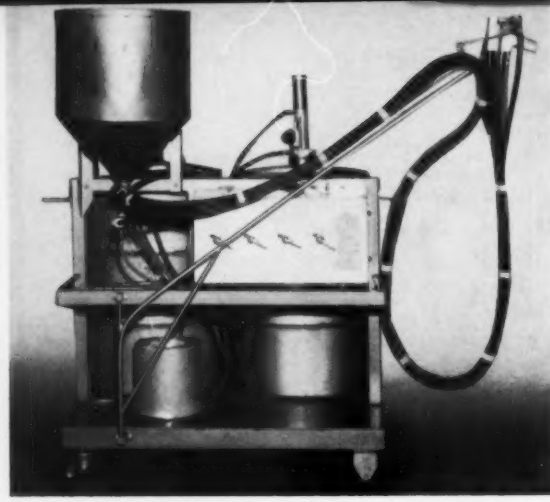
most anywhere. Present sprayup equipment is quite easily transported, and even more portable units are on the drawing boards. Wherever a man can operate a commercial paint spraying outfit, he can sprayup a laminate of reinforced plastics.

Sprayup enthusiasts talk by the hour about the possibilities, extend the list almost to infinity. Here are a few examples, based on experience or experiment:

- **All-plastics self-supporting warehouses, and other industrial structures.** Just erect a conventional airhouse, spray up reinforced plastics on the outside to the required thickness, let it cure, deflate and remove the airhouse—and start on the next structure. "Mold" possibilities are unlimited: the original form need be only strong enough to withstand spraying up and rolling. It can even be left in place indefinitely if more economical.
- **Machinery safety guards made on the site.** Use cardboard or other inexpensive forms, bend to shape, spray, and the job is done.
- **Swimming pools.** Dig the required hole and spray up directly against the bare ground.
- **Tank repair and maintenance.** Oil, water, and other storage tanks can be repaired or corrosion-proofed by sprayup. Life expectancy of metal and wooden tanks can be economically extended. In one repair job on a 40-ft. steel tank, a complete new bottom would have cost \$4/sq. ft.; sprayup repair, using isopolyester, 75¢/sq. foot.
- **Freight car repair.** Hand-layup of glass mat or cloth and brush application of resin has been used laboriously for years for repairing battered interior walls and floors. Sprayup can do a more satisfactory job in half the time.
- **Chicken coops.** Notoriously difficult to keep clean in the past; now a sprayup coating on walls, floors, and roosts gives a surface that can be washed down with a minimum of labor for optimum sanitation.
- **Chemical plant piping.** Lead pipe, used for its chemical resistance, needs heavy wall sections to give sufficient physical strength to bridge long spans. The extra wall thickness contributes nothing to the chemical properties, so thin lead pipe can be coated to sufficient thickness with sprayup reinforced plastics to give necessary strength. Lead is saved, weight reduced, corrosion service equalled.
- And from here the list runs on and on through industrial duct work; automotive body construction and repair; bathroom and shower stall walls, floors, and ceilings; concrete and



ALTERNATE DEPOSITION of glass and resin mix is used in the Hupp system. Top: resin spray being applied to a laid-down layer of resin and glass. Center: another layer of chopped glass is sprayed-on. Bottom: the sprayed-up layers are rolled down manually in order to assure a void-free laminate.



CONTINUOUS ROVING is applied with a combined resin spray in the Fiberlay process. Complete Fiberlay Spray Molder equipment is shown at right, with control panel, resin and roving supply, and the aggregate hopper for the fillers.

cinder-block surfacing; and roofing to jigs and fixtures, mold construction, and prototypes for short runs.

How the guns work

In conventional hand layup of glass mat or cloth, the problem is to get enough catalyzed resin into the glass to thoroughly wet the fibers and, at the same time, to eliminate voids or resin-starved areas. Once the resin, catalyst, and promoter have been mixed, there is only a limited time, or "pot life," during which the mix is fluid and workable. This imposes a serious time handicap and limits the glass-resin ratio of the laminate. High glass content is often desired to give adequate physical properties. But if the glass layer is too heavy, a sufficient quantity of resin cannot be worked into it by hand for a good, void-free laminate.

With the guns, two resin mixes are kept in separate containers until an instant before they are combined and meet the glass. One container holds a mixture of resin and catalyst; the other, resin and promoter. Separated, the mixes remain workable for as long as three or four days. Once they are combined, their gel-time drops to minutes, or even seconds. When the resin mixtures are forced through nozzles and mixed intimately either by impingement at a point between the nozzles and the mold surface

SPRAYUP SYSTEM used by Peterson consists of a double-nozzle resin spray gun which can be used in conjunction with an attachable glass chopper as shown, or separately for gel-coating or protective coating uses with resin alone.

or within the gun itself, the resulting spray of resin starts immediately to wet the surfaces of chopped glass roving (or continuous roving) which is either propelled toward the mold surface at the same time or deposited separately. Thus, as the laminate builds up, the glass is thoroughly coated with resin and only a rolling operation is necessary for compacting and eliminating air bubbles.

BROADENING USE of epoxies in reinforced plastics is expected to result from the development of the Gusmer gun, in which the resin and hardener are mixed in the gun and projected in a single spray together with chopped glass fiber. Photo, Union Carbide Plastics Co.

Sprayup systems

Once an idea as potent as reinforced plastics sprayup has been sparked, it is natural to expect a spate of claims and counterclaims; patent conflicts already have developed. However, our purpose here is to report on available sprayup equipment, and to analyze in terms of dollars and hours some of the results already obtained. The courts will rule on patent rights.

The check list, below, encompasses five organizations known to offer sprayup systems, including resin guns and glass roving feeders and/or breakers or choppers; auxiliary equipment, such as tanks, pumps, lines, gun counterbalances, etc., may be standard or optional.

Rand Development Corp.: Our first description of this system, called the "Rand Fiber-resin Depositor," was published in MPL, Feb. 1958, p. 119. Since that time it is reported that the Depositor has been improved to a point where it can lay down 6 lb. of laminate per minute, based on a 1:2 glass-resin ratio, using one 60-end roving. Rand also states that its two-nozzle gun, furnished by Paasche Airbrush Co., Chicago, Ill., but modified to Rand specifications, now has improved spray heads for better dispersion of resin, that better fiber orientation is obtained, and that continuous roving as well as chopped strands can be applied with the unit.

Says Dewey Eldred of Rand: "The speed of layup depends on the configuration of the part. We have found some parts made by the sprayup method to be absolutely (To page 210)

Check list for reinforced plastics sprayup equipment

Manufacturer	*Resins handled*[1]	*Resins mixed*[2]	*Laminate output lb./min.*[3]	*How sold*[4]
Fiberlay, Inc. 1158 Fairview No. Seattle 9, Wash.	P, E	ON	16	O
A. Gusmer, Inc. Woodbridge, N. J.	E	IN	2	O
Hupp Engineering Assocs. P.O. Box 3290 Sarasota, Fla.	P	ON	19	LN
Peterson Spray Gun Co., Inc. 1751 Leslie St. San Mateo, Calif.	P	ON	6	O
Rand Development Corp. 13600 Deise Ave. Cleveland 10, Ohio	P	ON	12	LR

[1] P = polyester; E = epoxy.
[2] ON = outside nozzle; IN = inside nozzle.
[3] Based on 33⅓% glass content and use of 60-end roving.
[4] O = sold outright; LR = license and royalties; LN = royalty-free license.

Want better school seats?

STUDY-CENTER has seat and back molded of high-density polyethylene, desk top of glare-free decorative wood grain laminate. Seat swivels on nylon bearings. Close-up front and back view of molded polyethylene components, which have a combined weight of 2½ lb. per chair, is at right. Holes and bosses allow attachment to frame. Pebble grain finish eliminates squirming, minimizes surface scratches.

Successful introduction of injection molded high-density polyethylene seats and backs for a new line of school furniture, offering manufacturing economies and numerous advantages over previously used materials, may presage an important new volume market for this material in the seating field.

These new plastic components have been adopted by American Seating Co., a major supplier of public seating, for its new Study-Center, a highly engineered combination seat and desk unit which was unveiled at the recent convention of the American Association of School Administrators in Atlantic City, N. J. They are produced by a Midwestern custom molder using a specially tailored formulation of Marlex high-density polyethylene (PE) made by Phillips Chemical Co. and designated Amerflex by Amsco. Selling in the $30 range (the exact figure depending on how many are bought and where), the center—called by the school trade a one-piece unit movable—is competitive with more conventional units.

Furniture is indestructible

The new seats and backs, developed through an extensive research and testing program, have been designed to stand up to the punishment an active child can hand out. The company describes the linear PE material as "as indestructible as iron, yet as supple as rubber." The molded seats and backs virtually eliminate costly maintenance experienced with conventional units requiring periodic repair or refinishing. Carrying their own integrally molded color, they are stain-resistant, washable, and will not splinter, dent, crack or flake. Accelerated laboratory tests conducted by American Seating (see below) indicate a minimum life of 30 years for the unit. (This is 10 years more

TRY POLYETHYLENE

Manufacturer of public seating turns to high-density PE for seats and backs for its top-of-the-line school furniture. Here's why they did it and how

than the average term of a school bond issue.) This 30-year figure, however, is only a minimum. Actually, the company guarantees the units without time limit.

Student comfort is another important plus factor of the new PE seats and backs. Although basically rigid, the components have sufficient flexibility to permit them to conform to body contours. The compound-curved seat and self-adjusting deep-curved back compel a proper, yet relaxed sitting posture. The integrally molded pebble texture not only minimizes the problem of scuffing and marring, but also eliminates squirming and sliding out of seats—an important consideration in view of the fact that the average student spends some 15,000 hr. *seated* from kindergarten through college.

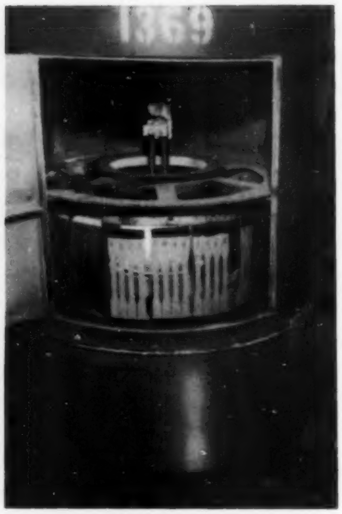
Adoption of the molded plastic seats and backs for the Study-Center helped make it

TEACHER'S CHAIR has arm rests of molded high-density polyethylene, while the back rest and seat cushion are molded vinyl foam.

Typical tests made on chairs

FORTY-POUND sandbag is dropped on assembled unit to test durability.

IN SWINGING IMPACT TEST, two 40-lb. sandbags hammer against back rest to simulate rough usage.



WEATHEROMETER TEST on molded samples evaluates ability of material and colors to withstand exposure to ultra-violet light.

possible for American Seating to offer a greatly improved product without an increase in cost to the schools. Although the molding material is inherently more expensive than wood, its use permitted redesign which simplified manufacturing operations. For example, the number of parts in the chair back was reduced from nine to four, thereby effecting economies in assembly operations.

The seats and backs are produced in integral colors, Coral and Parchment, that harmonize with the alkyd finish of the welded tubular metal frame. Both the seat and the book-box, which is topped with American Seating's Amerex matte wood grain melamine laminate, are adjustable vertically, so they can "grow" with the student. The seat moves back and forth and swivels 45 deg. on nylon bearings in either direction, permitting easy entry from either side and full visibility to all parts of the classroom. Nylon washers are incorporated in the rotatable seat mounting and in the slam-proof mounting of the book-box top, optionally adjustable to three positions.

Because of their unit design, these combination chair and desk assemblies can save as much as 25% in floor space. For example, the extra floor area gained in a 30- by 24-ft. classroom, valued conservatively at $12 per sq. ft., would be worth over $1,000.

Before specifying Marlex for its new Amerflex components, American Seating evaluated approximately three dozen types of materials from seven or eight different sources. This program, carried out under direction of B. W. Henrikson, manager of research and development, was part of a project which called for investigating possible replacement materials for wood veneer and reinforced plastics seats and backs which would be less expensive and/or more serviceable. Studies began with a crude, handmade model. Results looked so promising that management agreed to proceed with an experimental production-type mold. Visits to material suppliers' research laboratories were part of the procedure followed in finalizing material specifications.

Following material selection, there was a further modification program on the molds for proper contours, thicknesses, and stability of the parts until test results were successful. This was followed by a field test program to eliminate any final "bugs" before the seats and backs went into large-scale production. The sales program is just getting underway and no significant production figures are as yet available. However, several hundred schools have already placed orders; and many more have expressed a favorable interest.

Total poundage of linear polyethylene used per unit is about 2½, including 1½ lb. in the seat and about 1 lb. in the (To page 216)

For portable refrigerators, molded styrene foam takes over from metal

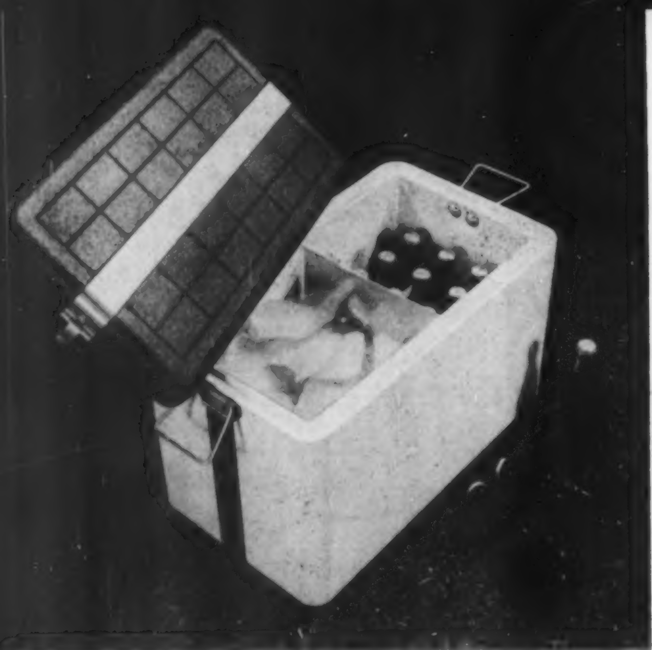
At a fraction of the weight of traditional cooling units, these new products provide equal and better insulation —at lower prices, too

ONLY one finger supports new lightweight expandable styrene cooler. Conventional units weigh over three times more. Closeup of unit (right). Mating tongue-and groove assures tight seal.

Picnic coolers molded entirely of expandable styrene foam—lighter, less costly, and far more efficient than coolers made by sealing insulating material between two nesting metal shells—may revolutionize this increasingly popular type of product. Two major suppliers are already marketing the all-foam coolers, others are reportedly getting ready to follow suit.

In a related development, molded styrene foam is also moving rapidly into larger containers designed for shipment, storage, and display of frozen foods. Here again, it offers a combination of extremely light weight for lower shipping costs, exceptional thermal insulating properties, and reduced costs of fabrication. Ice buckets, ice storage containers for home refrigerators, and even flower pots are among other products now being molded of expandable styrene foam.

Foam styrene has been used for years in the form of slabs or chips to insulate freezer compartment doors, ice cream cabinet lids, and refrigerated shipping containers. But, with *molded* expandable styrene beads, it now becomes possible to produce containers, picnic coolers and similar items in one main unit



MOLDED FOAM construction of KampKold portable refrigerator makes possible a unit which is less costly than conventional, insulated metal coolers, two-thirds lighter in weight, and will keep food fresh longer with less ice.

FROZEN-FOOD display box is fabricated from expandable polystyrene panels. Exceptional insulating efficiency of the plastic foam materials permits unit to be cooled by dry ice, eliminating need for a compressor and cooling coils.

(plus lid), eliminating dead weight and costly fabrication. The two primary suppliers for expandable polystyrene are Koppers Co., Inc. and the Dow Chemical Co.

Needs less refrigerant

Advantages of the one-piece molded plastic construction are clearly demonstrated by the new Styra-Lite KampKold Model KS-1 portable refrigerator, made by Queen Products Div., King-Seeley Corp., Albert Lea, Minn. Molded of expandable styrene beads, this unit measures 21 in. long, 13½ in. wide and 12 in. deep, yet weighs only 6 lb., making it 66⅔% lighter than a conventional steel picnic cooler. Equipped with a removable tray, this unit can accommodate 24 average size soft drink bottles.

After molding with white expandable styrene beads, the cooler is spray finished in polar yellow with cover in charcoal. Retailing at approximately $14.50, it is not only much less costly than metal coolers, but also more economical to use because it requires less ice to refrigerate.

Because of polystyrene's insulating efficiency, the new KampKold will safely refrigerate foods and beverages up to four days on one filling of ice, making it ideal for use on vacations or long weekend holidays. Another advantage over metal construction is that the all-plastic cooler cannot rust or corrode, even near salt water. Particularly appealing to boaters is the fact that this cooler, when fully loaded, floats, should it be dropped overboard.

3 times lighter, 3 times more efficient

The American Thermos Products Co., Norwich, Conn., recently introduced its new Chillybin foam plastic ice chest. This featherweight (6 lb.) unit will hold up to 40 lb. of ice and food or drinks. However, its insulating efficiency is so high that only a relatively small volume of ice is usually required.

American Thermos describes the Chillybin as three times more efficient, three times lighter and three times more durable than ordinary ice chests. In a dramatic demonstration during the recent National Housewares Exposition in Chicago, Ill., a Chillybin was filled with 30 lb. of ice cubes, then chained and padlocked shut. Four days and 2½ hr. later, when the container was unsealed, 9 lb. of ice cubes remained in the ice chest.

Base and cover of the Chillybin are molded with mating tongue-and-groove construction for a tight-sealing closure. The cover is finished

in green inside and out; the base is off-white with a black spatter effect. The molded plastic foam does not absorb moisture or odors, and a quick rinse after usage leaves the cooler fresh and clean. A metal drain plug, inserted into one end of the chest, facilitates removal of water. It is threaded to take a standard inner tube air cap, easily replaceable if lost.

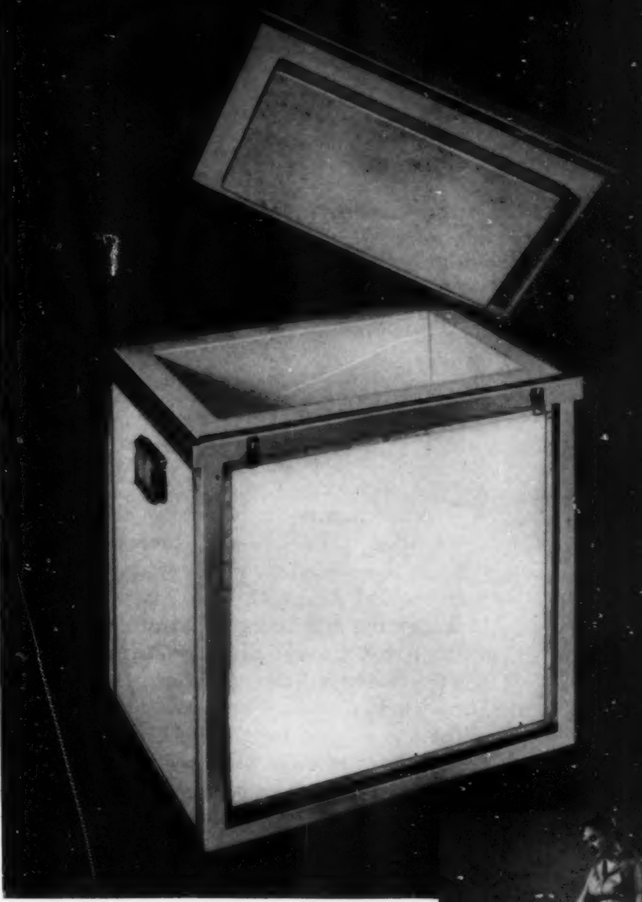
The Coleman Co., Inc., Wichita, Kans., is now using molded styrene foam insulation for its Snowlite beverage jug, which also includes a molded nylon spigot. The material is expanded and fused under pressure, forming an insulating shell which surrounds the inner liner of the jug. A special insulating seal gasket blocks heat transfer between the liner as well as the outer casing.

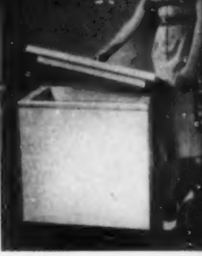
For its new "Magic Touch" Handi-Stor ice cube trays, Inland Mfg. Div., General Motors Corp., Dayton, Ohio, provides an insulated ice chest molded of expandable styrene beads. To use this combination unit, the housewife lifts off the ice chest cover and inverts the metal ice cube tray over it. A touch of the release lever allows the cubes to fall into the chest, where they remain crisp and dry for hours, ready for instant use.

Dry ice cost cut 60%

A new frozen food display box affording extra storage and display space for retail food merchandisers is now offered by Consolidated Brokerage, food and merchandise brokers of Denver, Colo. Available in two sizes—4 by 2 by 2 ft. and 3½ by 2 by 1 ft.—the boxes are insulated with panels, fabricated from expandable styrene. With these containers, retailers may offer individualized displays of frozen products anywhere in the store, without entangling wires or the need for electrical outlets. Safe temperatures are economically maintained up to three days with a single supply of dry ice. One large national chain organization credits the foam-insulated boxes with cutting the dry ice costs for its frozen food shipments by more than 60 percent.

In its new Freez-Safe 5-cu.-ft.-capacity portable frozen food transporter, Glo-Brite Products, Chicago, uses a one-piece molded expandable styrene foam insulating core believed to be one of the largest units of its kind. Measuring about 28 by 28 by 19 in. deep, the core is approximately 2½ in. thick and weighs only 14 pounds. The foam plastic walls, equivalent to 4 in. of cork insulation, weigh only one-fifth as much as cork.





FREEZ-SAFE portable frozen food transporter and display unit with 5-cu. ft. capacity includes molded expandable styrene core weighing only 14 lb., despite its size. Interior and exterior surfaces are formed from Royalite sheet stock. Model at right gives an indication of the size of the 5-cu. ft. unit. The units are also produced in 2½- and ¾-cu. ft. sizes.

The expandable styrene insulating core is molded by steam expansion of the styrene beads. Inner and outer shells of the Freez-Safe are formed from Royalite ABS polymer blend sheet stock, supplied by United States Rubber Co. Designed to carry up to 175 lb. of frozen foods, the unit will keep the merchandise solidly frozen with only a moderate temperature rise for a full 72 hr. by using only a small amount of dry ice.

The cases cited above are only typical examples of many more. There is strong evidence that we'll be seeing many more applications of molded styrene in insulated products. Both Dow and Koppers are actively promoting this market—and the triple benefits of more efficiency at less weight and lower cost will be hard to resist.—End

How molded nylon-phenolic pressure strips make possible double hung windows with removable sash and no counterweights, giving maker potent merchandising advantage

Windows without

From masonite to wood to aluminum to nylon-filled phenolic—and success! This, in brief, is the case study in materials engineering that enabled Andersen Corp., Bayport, Minn., to design the maximum in performance at reasonable cost into the pressure strips which are key components in the operation of their double hung window units.

The strips—two for the top and two for the bottom sides of each window—are attached to the edge of the sash in such a way that when a thumb lever on the window frame is released, two mounting screws slide to the bottom of slots molded into the strip through which they pass (see photo, right). This action forces the sash tightly against a parting stop and holds it in place. Conversely, when the lever is depressed, the screws slide to the opposite end of the slots, the pressure strips move horizontally to the side, and the sash is now ready for free vertical movement in the sash run or for easy removal.

Selecting the right material

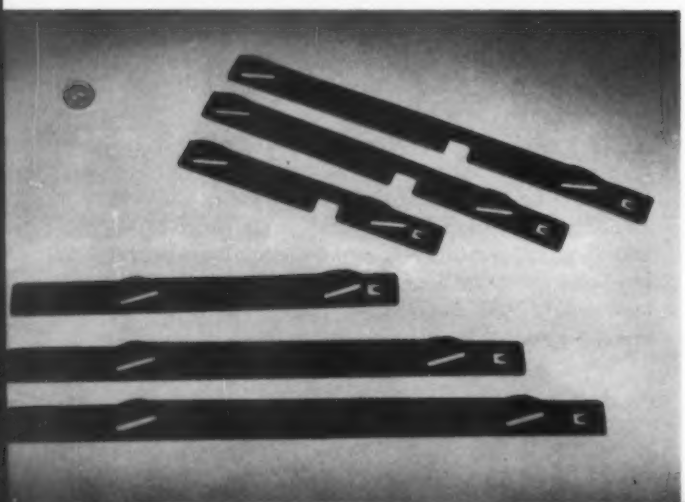
Originally the company had considered a masonite-type strip for the job, then a wooden strip; and finally settled on an aluminum piece. The aluminum strip, however, suffered from several disadvantages (discussed below) and company engineers turned their attention to plastics. They felt that the special qualities of toughness and elasticity demanded by the application might conceivably be satisfied by a plastic composition and a wide variety of thermoplastics and thermosets were put to the test.

Initial results pointed to thermosets as likely candidates. Of the thermosets tested, nylon flock-filled phenolic performed best; and at the start of this year, the company started to switch its production over to the material. While the costs of the plastic strip and the aluminum strip are comparable, the company felt that the many functional advantages obtained justified the changeover. According to a company spokesman, "The main reason for the change was to get a smoother operation of the pressure strips, to eliminate the black marks which the aluminum strip left on the wooden sash, and to prevent galling, pulling, or sticking between the metal screws and the slots, thereby providing more holding power to support the weight of the window."

Tests also showed that the use of nylon flock as a filler contributed to the elimination of slippage between the screws and the strips.

The pressure strips are molded by Kurz-Kasch, Inc., Dayton, Ohio, using Fiberite 1303-A supplied by The Fiberite Corp., Winona, Minn. Tooling consists of three 10-cavity combination compression molds with five upper

VARIOUS SIZES of nylon-phenolic pressure strips. Two are used per window; 25¢ piece at the upper left is for scale.



UPPER and lower molds are shown here fully loaded with molding material. In foreground is volumetric loading board used to fill cavities.

weights

pressure strips and five lowers produced in each mold. Reason for the large number of cavities is that different sizes are required for different groups of window dimensions.

Set-up for precision molding

To provide the best wearing surface conditions possible, the molds had to be precision engineered so that the slide slots and the pressure gripping surfaces are as free of horizontal flash as possible. Generally, because of the nature of the nylon filler, heavy flash is extremely difficult to remove. Kurz-Kasch currently uses barrel tumbling followed by airless blast cleaning. Extreme care is also taken during molding to prevent edge warpage which might impair the gripping surface of the two projections which lock against the sash.

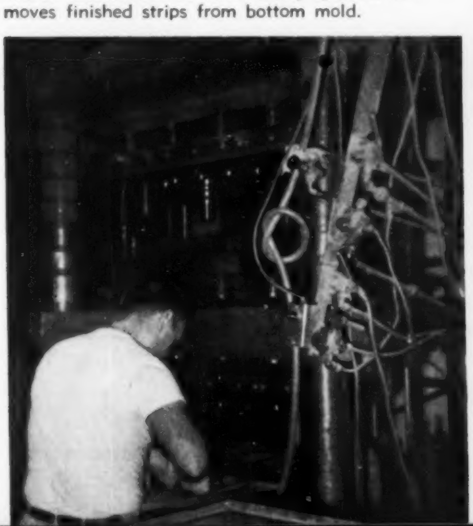
The nylon-filled phenolic is used in a modified granular form and is not preformed. The reason for this is that some of the strips are quite long and thin (average gage is about 0.107 in.) and the flow characteristics are such that the piece requires a relatively even load across the entire length of the cavity. Cavities are filled with accurately measured charges by means of a volumetric loading board.

In order to obtain volume production on the strips, a double-decked molding operation was engineered. It is devised so that the operator moves by elevator from one level to another with his volumetric loading boards. This technique makes possible simultaneous operation at both levels—and increased output.

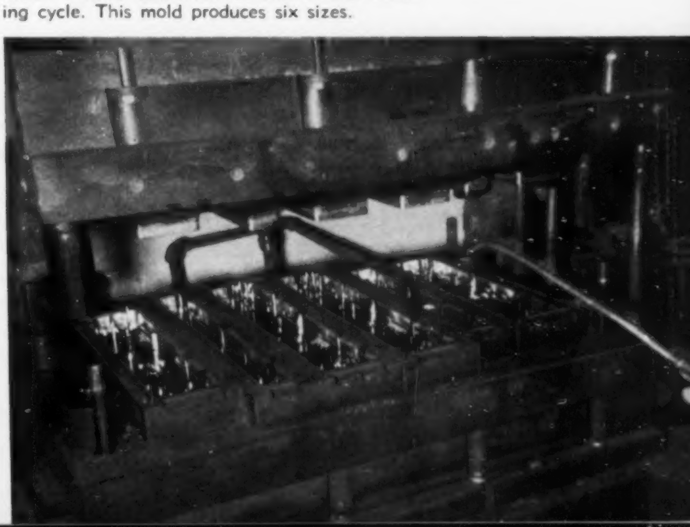
DOUBLE HUNG WINDOW with new pressure strips and without counterweights is easily removed from frame.

Looking at the entire operation from the standpoint of both the end-user and the custom molder, it becomes obvious how the engineering minds on either side can successfully mesh to provide a smooth transition from conventional materials to plastics.—End

WITH ELEVATOR at lower level, operator removes finished strips from bottom mold.



MOLD BEING CLEANED at end of the molding cycle. This mold produces six sizes.



Molded PVC cushions

What advantages can the furniture manufacturers derive from going to molded vinyl foam? Here is the experience of several major companies

MOLDED, reversible T-cushion made of vinyl foam produced by the Elastomer process is lower in cost than latex foam, satisfies comfort requirements. Photos on following pages illustrate steps in making such cushions.

The enthusiasm with which several leading furniture manufacturers—and their customers—have greeted the introduction of molded contoured vinyl foam cushions, produced by Union Carbide Plastics Co.'s Elastomer process, holds a strong promise that the material may soon become a significant factor in the cushioning market. And this despite the fact that production on a commercial scale has just begun.

For example, International Furniture, Div. of Schnadig Corp., Chicago, Ill.—one of the country's largest furniture manufacturers—until a few months ago sold sofas and chairs with cushions in this ratio: 60% latex foam, 40% spring construction. Shortly after the introduction of vinyl foam the sales pattern changed to 40% latex, 20% spring, and 40% molded vinyl foam.

This phenomenal switch represents convincing evidence of substantial dealer and consumer acceptance of the new product; and the reason behind it lies in the combination of economy, comfort, and proven durability which the new material provides.

A step-by-step outline of how these cushions are molded is presented in the accompanying illustrations. These also give a fair indication of the equipment involved in such a production line.

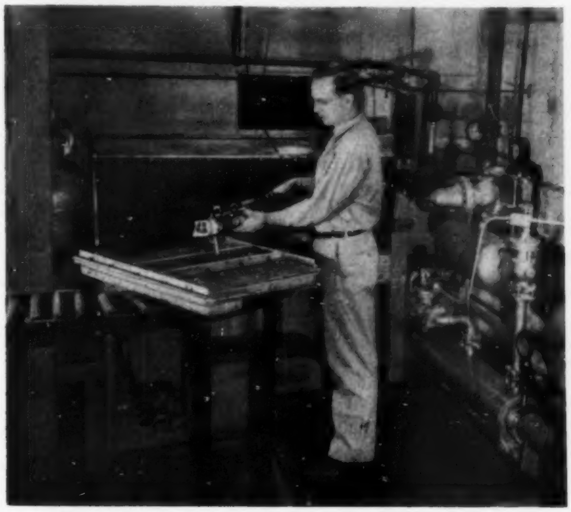
What are the savings?

Manufacturing economies in the furniture industry—as in most other industries—depend either on reduced processing costs or on lower material costs. In both respects, vinyl plastisol foam is in an excellent competitive position.

Molding is the key to lower production costs, since a crowned, contoured, fully- (To page 100)

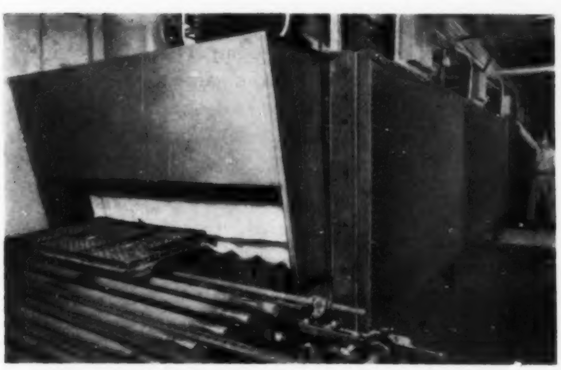
invade furniture field

How cushions are molded, step by step



1 OPERATOR is using nozzle system to inject "wet foam" into T-cushion mold. Number and location of injection points is determined by size and configuration of molded cushion. Mixture resembles whipped cream and is a 1500 to 1800% expansion of the original vinyl plastisol formulation. At right can be seen part of the Votator foamer made by Girdler Div. of Chemetron Corp. for use in this process.

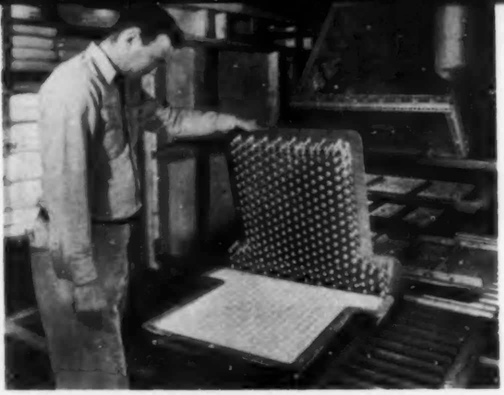
2 SIMPLE FUSING OPERATION converts the mixture into finished foam. Mixture is a mechanical combination, there is no chemical reaction, nor are there any solvents to be removed. At left, mold is leaving foam filling area to be transported to fusing oven in center.



3 MOLD LEAVES fusing oven after curing period of approximately 25 minutes. High velocity hot air heating (electric or gas) is used. Temperature throughout oven is constant at 370° F.

4 AFTER LEAVING OVEN (right background), molds are conveyed into cooling section, which utilizes a series of fans to bring temperature of foam down to handling range of approximately 100 to 150° F.

5 AT THE END of cooling section, (note fans at top right) molds come into stripping position. Plate of first mold on main conveyor is just being lifted, exposing fully cured molded vinyl foam cushion, which is then stripped out. Empty mold (in foreground) is ready to go back into foam filling station. Three injection points used for T-cushion are identified by arrows. Cored halves of cushion are inspected by operator in center prior to bonding.



6 COVER PLATE, with core pins, is removed, showing half of a finished cushion. The molds are aluminum casting. The total mold fillout insures uniformity of the cushions.

7 TOUGHNESS of vinyl foam makes stripping from mold easy and fast, without danger of tearing the molded cushion half.

8 TWO CUSHION HALVES about to be bonded with a vinyl based cement produce reversible, cored, and contoured cushions shown at right, and on racks at rear.

molded cushion merely has to be inserted into its cover without requiring any additional fabrication. Urethane foam, which also competes for the cushioning market, is generally available only as slab stock for furniture applications. Expensive in-plant cutting and other fabricating operations must be used to produce a raised center or crown; edges and corners—eight in the case of a reversible cushion—must be shaped to acceptable contours. In addition, such hand-crafted cushions are not likely to have the degree of uniformity that is provided by molded units. Since cushion covers are cut in bulk, uniformity of the filling is essential to avoid fabric wrinkling and maintain a showroom look, when fabric stretches slightly in ordinary use.

Latex foam, which is the leader in the cushioning market, can also be molded. But vinyl foam is lower in cost. For example, a contoured molded vinyl foam cushion, measuring 24 by 24 by 5¼ in. costs $5.00, compared with $6.50 for a latex cushion with the same dimensions. For many applications the cost of molded vinyl foam cushions is comparable to the cost of slab stock of other flexible foam materials, such as urethane and rubber.

How to define comfort

Comfort is perhaps just as important as price in the cushioning field, and latex foam has been tremendously successful as the most widely acceptable replacement for down cushioning. Unfortunately, there is no accepted measure of cushioning comfort. What is "comfortable" to one person may be too "hard" to another, too soft to a third. Vinyl foam is not as spongy as latex, but it certainly has the cushioning characteristics which are normally considered desirable, and some manufacturers who are using both latex and molded vinyl

cushions call both simply "foam cushions." The term "foam cushion" to cover both vinyl and latex foam is one that both the latex and vinyl foam producers regret. The former feel that their product has gained consumer acceptance over the years and a new product should create its own reputation. Vinyl foam producers, on the other hand, prefer to market their material on its own merits and would like dealers to educate the public on the product differences. What the ultimate nomenclature will be is anybody's guess.

Generally speaking, the properties of molded vinyl foam are those of vinyl, since a straight 100% polyvinyl chloride plastisol resin is used in the Elastomer process. These properties include exceptional durability, fire resistance, and dimensional stability. Various plasticizers, stabilizers, and other additives are used in the foaming mixture. The types and percentages of plasticizers which are added vary according to the load bearing characteristics desired in the final molded product.

It is too early to forecast the pattern which the molded vinyl foam industry is going to assume. At present, it is a custom molding operation, and the molds are paid for by the cushion user. This custom procedure is the same as that embarked upon by the latex manufacturers during the early days of molded foam rubber cushions.

In addition to International Furniture, for whom Brown Rubber Co., Inc., Lafayette, Ind., is molding the vinyl cushions, Pullman Couch Co. and Oklahoma Furniture Mfg. Co. are also spearheading nationwide marketing of furniture featuring molded vinyl foam cushioning.

Textured surfaces

The Elastomer process for making vinyl foam by mechanical mixing is not confined to contoured, cored molded cushions, such as those used by the furniture companies mentioned above.

Interesting possibilities with significant economic implications are also presented by the feasibility of using such cushions with an integral cast textured vinyl skin, thus by-passing the upholstering operation.

For such applications, the skin may have an unlimited number of surface designs and colors. The process involves using a cored and contoured mold that has the desired pattern cast or formed into one or more of its internal surfaces. Then an unexpanded plastisol of the desired color is brushed, sprayed, or slush molded onto the preheated mold surface. An unexpanded skin of the indicated pattern and color is thus formed. (In the conventional process, molds do not have to be preheated and the plastisol is pre-expanded.) Foam is then added, the mold cover plate is positioned, and the entire assembly is fused, cooled, and stripped as one unit.

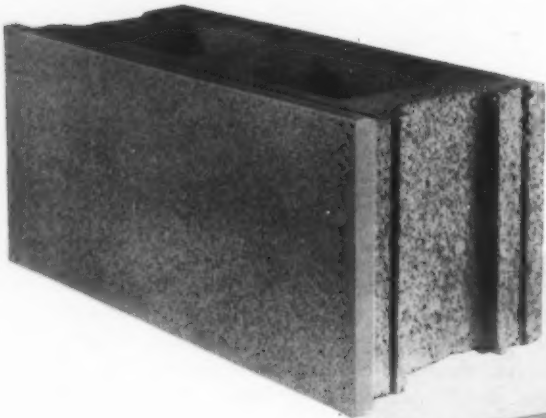
Simmons Co., New York, N. Y., uses such cushions in a new indoor/outdoor chair created by Raymond Spilman, industrial designer (See photos, below). Intended primarily for pool-side, patio, and motel use, the new chair has six modular vinyl foam cushions, molded by U. S. Rubber Co., and measuring 6 in. by 19½ in., with a thickness of 1½ inches. They are spaced one-half in. apart, and cemented to a welded steel framework with a vinyl-based adhesive. The combination of a vinyl skin and vinyl foam produces a chair that is washable and weather-resistant.

The T-cushions and other cored and contoured reversible cushions used by such companies as International, and the modular cushions with an integral textured skin used by Simmons, demonstrates that molded vinyl foam is a strong contender for both traditional furniture as well as for items based on new concepts.

In both cases, good performance characteristics and the prospect of important savings in processing costs are likely to contribute to the anticipated overall growth of the vinyl foam market.—End

INTEGRAL VINYL SKIN eliminates upholstering operation with these molded vinyl foam cushions, used on an outdoor/indoor chair. Cushions are cemented to welded steel frame and can be easily replaced to introduce a new color scheme. Sun chairs and chaise longues are made by adding more cushions to a longer frame.

How builders can profit with



CLOSE-UP of polyester-faced concrete block. Facing can be applied to all sides, is available in wide range of colors and designs.

MODERN EXTERIOR of Clayton, Mo., building is achieved by using new concrete block in conjunction with brick. Granite or marble would have resulted in considerably higher cost.

It now looks as if polyester-faced concrete block is finally going to enter the construction field in large volume. The company instrumental in bringing about this development is Volz Products Inc., St. Louis, Mo., which has just introduced a new type of polyester-faced block under the tradename Aristocrat. While at present about three-and-a-half times as costly as standard cement block, the new variety nevertheless offers substantial savings to the builder who has to erect cement walls finished on one or more sides.

What is the cost picture?

Because of local differences, the exact amount of money saved will vary. However, a typical example from the St. Louis area can serve to illustrate the over-all picture: The selling price of an 8- by 16-in. block (128 sq. in.) is $1.14. Installation is 50¢ per block, for a total installed cost of $1.64. An alternative material, glazed tile, costs 41¢ each for a 5- by 12-in. (60 sq. in.) unit, with 22¢ for installation. Back-up costs bring the total up to $2.02—for half the area covered by the polyester-faced block.

In the New York area, according to George F. Hoffmann, sales manager of Nailable Cinder Block Corp., Brooklyn, N. Y., the cost of the new block approximately equals the cost of plain block and glazed tile combined. However, use of the new block eliminates the cost of installing the tile—for an appreciable over-all saving. The new blocks are also less costly than marble or granite.

Polyester faced blocks are not new in them-

polyester-faced concrete

New material of construction becomes economically feasible,

thanks to nationwide system of distribution

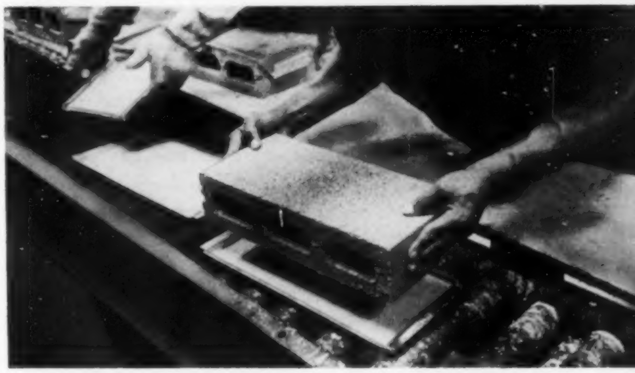
selves. What distinguishes the Aristocrat block —in addition to several structural and production aspects—is the system of distribution through which it is sold.

Concrete blocks cannot be economically shipped over distances of more than 50 to 80 miles. Thus, for any polyester-faced concrete block to become a large-volume item, it is necessary for the company that develops the block to set up a national system of franchised licensees, strategically located throughout the country, who will produce the blocks locally to that company's specifications.

This Volz has now done: The firm developed formulations, production techniques, and machinery and then licensed other companies to make and sell these blocks (in addition to its own manufacture and sale). As this is written, over 80 franchises have been issued in the United States and Canada, and negotiations for foreign licenses are in progress.

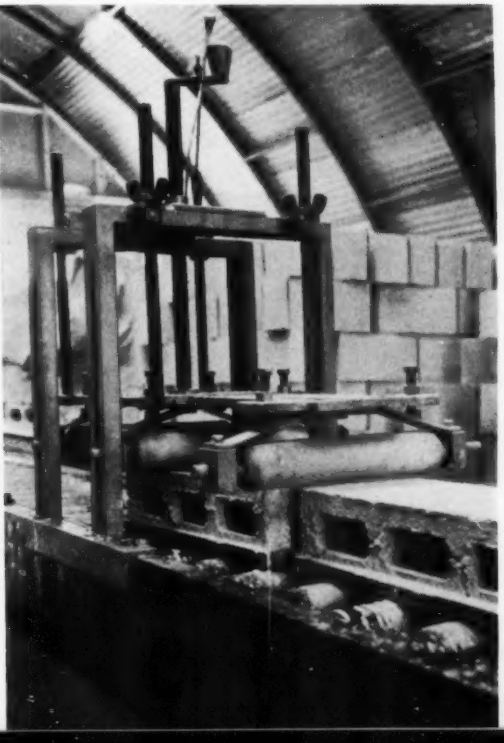
The initial cost of getting into production is

Three steps in producing polyester facing

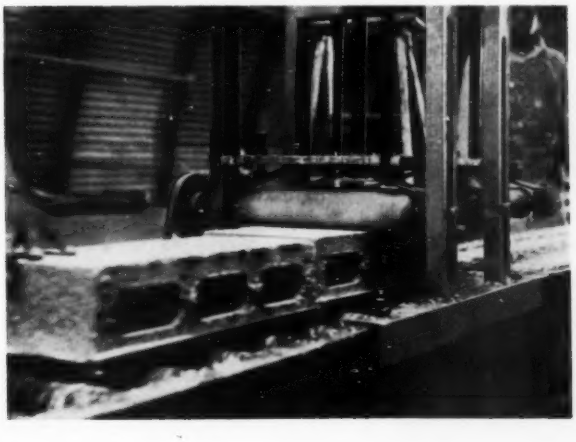


1—POLYESTER-FILLED PANS are placed on roller conveyor at left. In center, operator places concrete block to be faced in pan.

2—BLOCKS ARE PRESSED into polyester-aggregate in pans as they move under preset "equalizer" where desired facing thickness, which varies from ⅛ to 3/32 in., is obtained.



3—COMING OUT AT OTHER END of equalizer, panned block will next be palleted for overnight cure, followed by a wet-cutting operation that imparts matte polish to facing.



less than $6000. This is not a licensing fee but covers two Volz-built machines (one a unit, the equalizer, that controls the thickness of the polyester-face, the other a wet-cutting machine) and all the necessary recipes and know-how. The licensee also agrees to buy the ingredients for the formulation from Volz. This relatively low investment is probably the reason that over 80 firms have become involved in the development. In back of the low outlay is the fact that the Volz system requires no expensive heating equipment, which is the case with other systems. The initial investment for earlier systems ran about 10 times as much as for Volz's.

How the block is made

The Aristocrat block has a facing (on one or both sides) of polyester resin mixed with a decorative aggregate, such as marble chips, oyster shell, or the like. Thickness of the face varies from 1/8 to 3/32 in., depending on the type of aggregate used. The aggregate extends all the way through the facing. On the average, about 1/4 lb. of polyester goes into one facing.

In making the facings, the various ingredients are first combined in mixing machines. An operator then dispenses a predetermined amount of the mixture into a shallow pan slightly larger than the block to be coated (cost of pan is about 65¢). Another operator then places a concrete block into the filled pan and the entire assembly goes under the "equalizer," where the proper facing thickness is obtained. The equalizer incorporates a series of rolls under preset tension that press on the block to give it its desired dimension. After the "equalizing" operation, the block, still in the pan, is palletized with other blocks for overnight cure. After cure, it is depanned and wet-ground to a smooth finish, the pans being returned to the dispensing station for the next production run. This procedure is repeated for each side to be faced.

At the moment, all these operations are performed manually by all producing firms. However, the system is such that it could easily be fully automated should production warrant. Conservative estimates on 1959 production place the figure at over 12 million blocks.

The finished block does not have a separate polyester top skin; instead the face construction is uniform right to the surface. This feature is claimed to have two advantages: 1) good weatherability and 2) feasibility of repair, using the same composition, that is easy to perform but impossible to detect. Nine standard colors are currently being produced. The block conforms to ASTM C 90-44 for Grade A block. Polyester resin for the faces is supplied by American Cyanamid Co.

Applications

Both interior and exterior uses are indicated for the block. The block has also been effectively used as flooring. In interior constructions blocks faced on both sides can produce finished wall for two rooms in one operation. Anticipated applications include hospitals, swimming pools, schools, locker rooms, bakeries, dairies, packing houses, storefronts, and a large range of other structures.

The success anticipated for this development marks another milestone in plastics' effort to penetrate the building construction field. The combination of economy, beauty, and utility offered by these blocks points the way for the deepening of that penetration.—End

INTERIOR WALLS made of decorated concrete block. Once blocks are in place, no finishing is required. Adjoining rooms can share same walls without any finishing operation by using double-faced blocks.

1

2

3

INSTALLATION of rigid PVC coupling: **1:** Coupler, 6 in. long, end to end, is slipped over customer pipe line at point of service connection to gas main. **2:** Having no molded ridge on its inner surface, the coupler is slipped completely onto one of the pipes being joined, permitting easy realignment of pipe ends without need for fitting or cutting in field. **3:** Half-inch ring of unplasticized pipe is inserted in gap to prevent pipe ends from making contact inside coupler when it is slipped back in position over the pipes. **4:** Rubber gaskets in insulating coupler provide a firm, permanent seal when ends of coupler are tightened.

4

Rigid PVC coupler

cuts material, installation costs

Compression-type couplings, injection molded of unplasticized PVC by Tube Turns Plastics, Inc., Louisville, Ky., are bringing significant savings to natural-gas utility companies. Used in the service pipe between natural gas mains and customers' property lines, these couplers prevent corrosion caused by flow of stray electric currents—a major cause of leaks, service interruptions, and high maintenance cost.

The new fitting replaces a previous method of insulation that involved insertion of about a 2-ft. length of butyrate pipe, male-end adaptors connected to a valve at the gas main, a stiffener inside the length of the plastic pipe, and two steel compression fittings for coupling to the customer's line. The items have all been replaced by the single new insulation coupling at an estimated saving of 20% for material and a concomitant decrease in inventory costs. The coupler also eliminates a major installation step —shop assembly of the various components used with the old system. Ease of installation with the Tube Turns Plastics coupling is illustrated in the series of four photographs above.

The fittings are produced by the Hendry process, involving an injection machine with vertical screw preplasticator.

The significance of the potential savings are pointed up by the fact that, according to the molders, the nation's utilities are adding service connection for more than 800,000 new customers each year.—End

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Blow molding polyethylene –Part 1

By R. L. Wechsler[†] and T. H. Baylis[†]

This is the first quantitative report on how processing and material-selection factors in extrusion/blow-molding influence wall thickness, crystallinity, permeability, and minimum cooling time of polyethylene bottles. Surprisingly, permeability to lemon oil varies inversely with the *square* of the wall thickness over the range studied. Over the working viscosity range from 10^5 to 0.5×10^{10} poises, bottle weight (i. e., wall thickness) passes through a maximum value due to the conflicting actions of drawdown and strain recovery in the parison. At about 10^6 poises, drawdown is so severe that the parison "runs away;" it is shown that this "run-away viscosity" can be predicted from the resin's melt index. Part 2 will discuss gloss, welding efficiency at seal, wall uniformity, and shrinkage.

From the broad spectrum of available polyethylene blow molders have selected resins in two relatively narrow ranges of melt index and density. For squeeze bottles, suitable resins lie in the density range from 0.920 to 0.923 g./cc. and have melt indexes from 1 to 3 dg./min. Rigid bottles are blown from resins ranging from 0.950 to 0.960 in density, 0.2 to 3 in melt index.

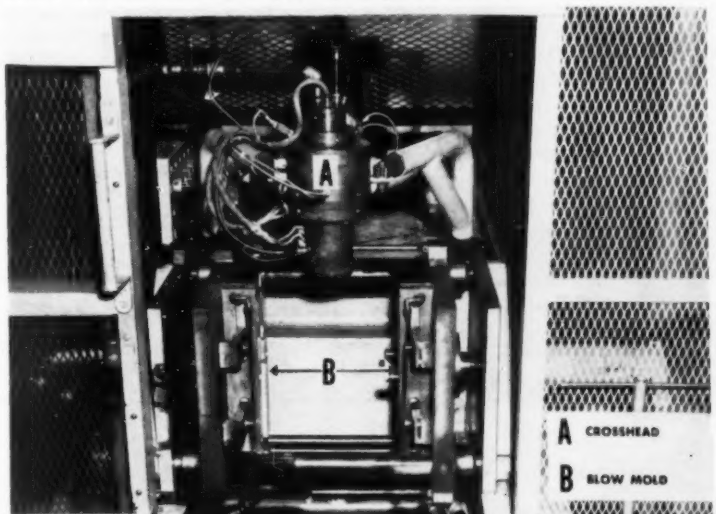
For the squeeze bottles, other things being equal, it would be desirable to have as stiff a resin as possible to minimize wall thickness. However, it is found that the bottles of the stiffer resins do not recover with sufficient rapidity after squeezing to perform the squeeze bottle function. The 0.920 to 0.923 density range gives resins which represent a compromise between stiffness and rate of recovery after squeezing. The melt index range of 1 to 3 also represents a compromise, this time one between principal properties — particularly stress-cracking resistance—on the one hand, and processability and cycle time on the other. This will be discussed in more detail later.

In the rigid bottle field, where squeezability is no longer a concern, the choice is naturally the stiffer resins so that wall thickness can be minimized. The generally lower range of melt index is dictated by the need for a high level of stress-cracking resistance and toughness.

Laboratory studies

Extensive laboratory studies have been made of the blow molding process, using an extruded-tube parison. The studies were made in laboratory equipment which consisted of a conventional injection molding heating cylinder feeding through a crosshead and tubing die to intermittently form a parison. The mold was mounted in a specially designed single cavity blow molding machine. A photograph of the equipment is shown in Fig. 1, below. A drawing

FIG. 1: Fore-end of extruder showing crosshead from which tubular parison is extruded and two halves of blowing mold in wide-open position. Mold was mounted in specially designed machine.



* Reg. U. S. Pat. Off.
† Development Laboratories, Union Carbide Plastics Co., Div. of Union Carbide Corp., Bound Brook, N. J.
Adapted from a paper presented at the 15th Annual Technical Conference of the Society of Plastics Engineers.

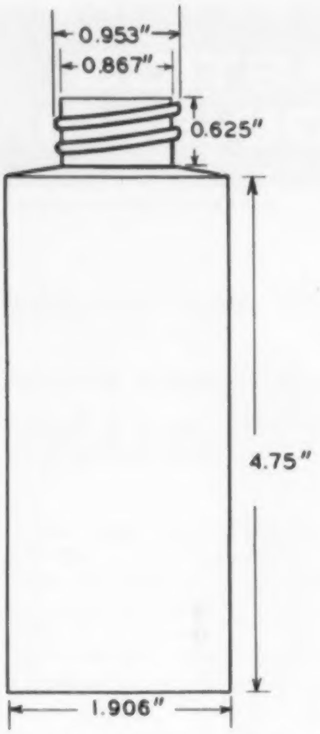


FIG. 2: Shown here is sketch of inside surfaces of blow mold for 6-oz. bottle.

of the bottle molded is shown in Fig. 2, above.

The information which has been developed with this equipment will apply, to some degree, to the whole area of blow molding with extruded tubes.

A variety of polyethylene resins were used in the studies. Data collected with six of the resins has been selected to illustrate the effects of the resin variables, melt index, and density. The properties of these resins are shown in Table I, above right.

Resins *A* and *C* form a series with *B* in which the melt index is varied over more than a hundred-fold range (0.11 to 14.6 —ten-fold on either side of the present commercial melt index range for squeeze bottles). These resins are similar in density and molecular weight distribution and afford a good estimate of the effect of melt index on the balance of bottle properties and cycle time, at the squeeze-bottle density level. Resins *E* and *F* afford a similar estimate at the rigid bottle density level. Resins *B*, *D*, and *F* together form a series in which the melt index is comparable and the density varies over a wide range.

Among the many properties of blow molded pieces of practical importance, some are essentially unaffected, others are slightly affected, and still others are strongly dependent on the molding conditions employed.

The properties essentially unaffected by molding conditions are: 1) Strength and toughness; 2) chemical resistance; 3) dimensional stability; and 4) stress-cracking resistance.

From the lack of effect of the molding conditions on these properties, it is evident that the blow molded pieces retain relatively little molecular orientation or molded-in stress. These properties *do* depend on the resin used. The effects of the resin variables on these properties have been discussed extensively in the literature.

Properties such as permeability and stiffness, which depend primarily on the crystallinity of the polyethylene, are slightly affected by changes in molding conditions. In general, changes which cause faster cooling (quenching) will reduce crystallinity and consequently increase permeability and decrease stiffness. Comparison of the two curves of Fig. 3, below, shows, for example, that decreasing the mold temperature, and thereby increasing cooling rate, slightly decreases density and increases permeability. These effects are not usually large enough to be important.

Table I: Resin properties

Resin	*Melt index* *dg./min.*	*Density* *g./cc. @ 23° C.*
A	0.11	0.920
B[a]	1.19	0.920
C	14.6	0.920
D	1.27	0.929
E	0.26	0.950
F	1.35	0.950

[a] Resin B is used in large quantities for the production of squeeze bottles.

Other important properties depend strongly on the molding conditions employed. The factors found to be affected are: 1) Piece weight and wall thickness; 2) minimum cooling time; 3) piece appearance (gloss, die lines, roughness); 4) shrinkage; 5) pinch-off (welding efficiency at the seal); and 6) wall thickness uniformity. Some of these properties are also affected by the melt index and density of the resin. These effects are detailed below.

Effect of molding and material variables on bottle properties

Bottle weight and wall thickness. In blow molding an extruded tube, the weight of the piece is fixed at the instant that the mold is closed on the parison. The wall thickness of the piece depends on the dimensions of the entrapped tube and the distance

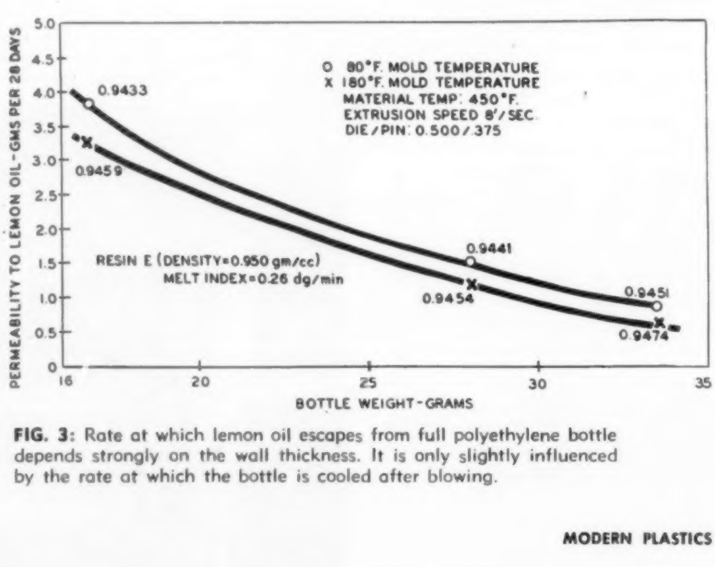
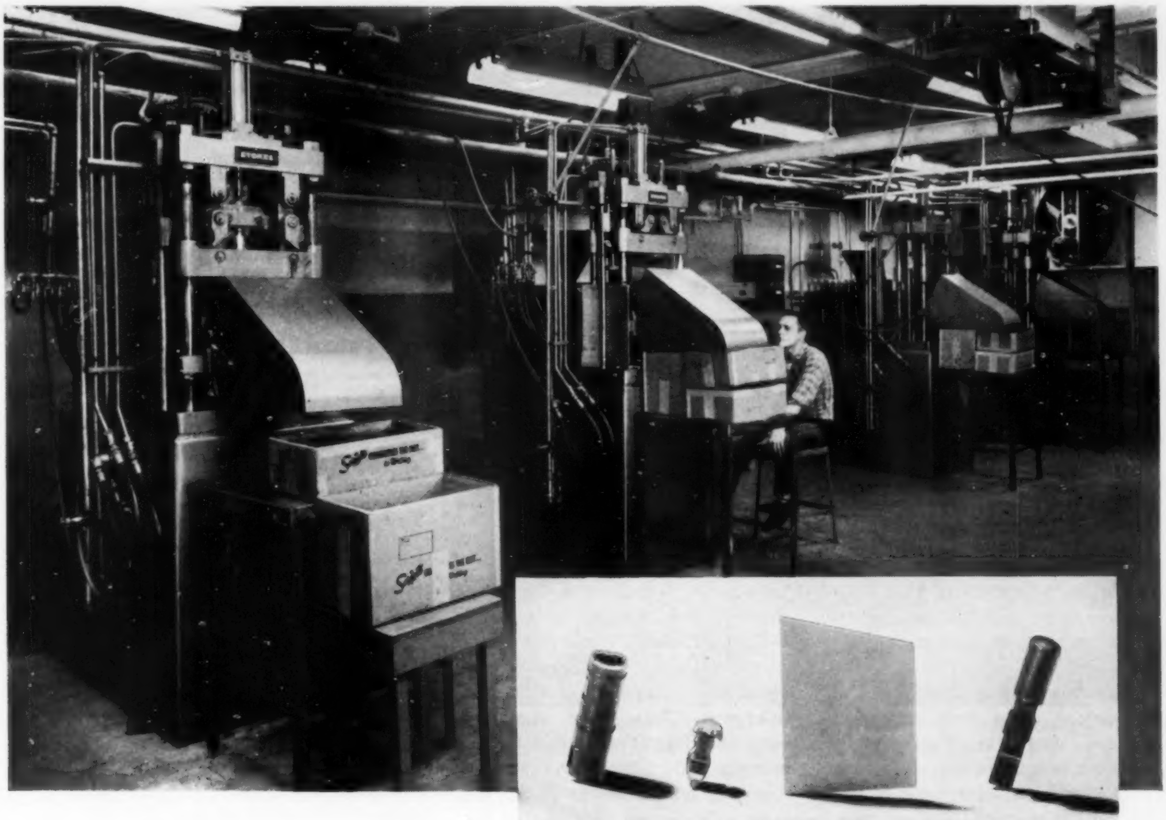


FIG. 3: Rate at which lemon oil escapes from full polyethylene bottle depends strongly on the wall thickness. It is only slightly influenced by the rate at which the bottle is cooled after blowing.



Scripto INC. selects Stokes 701 injection machines for truly automatic, high speed production

Scripto, Inc., Atlanta, Georgia—one of the country's best known makers of ball point pens, fountain pens, and automatic pencils—has augmented their large array of semi-automatic machines with Stokes fully-automatic presses. Four Stokes Model 701 Automatic Injection Molding Presses were selected for fully automatic operation, positive ejection and high speed operation.

Three are molding miniature parts out of Nylon for Scripto's famous ball point pens. The fourth machine is producing a panel of acrylic for their "visible fuel supply" cigarette lighter. All are in operation 24 hours a day.

Uniformity of cycle and production meets Scripto's high quality control standards . . . and truly automatic operation permits one-man supervision of all four presses.

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Write for literature on the Stokes Model 701—ask for a Stokes production analysis on your own parts.

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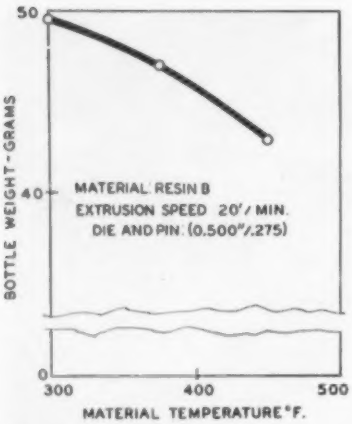


FIG. 4: When die/pin clearance is large, the bottle weight drops off as temperature rises.

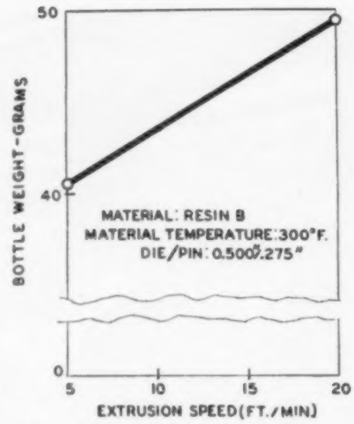


FIG. 5: Less drawdown, more strain recovery make thicker walls as extrusion rate increases.

that it is blown out. The first operating problem of the blow molder is to set his equipment and conditions to obtain the desired wall thickness.

Three molding factors affect the dimensions of a tube extruded vertically downward. Tube weight per unit length is increased as: 1) Die and pin clearance is increased; 2) material temperature is decreased (occasionally this rule is reversed); and 3) lineal output rate, (i.e., extrusion speed) is increased.

The effect of die and pin clearance is obvious. Varying this clearance by changing the position of a tapered pin or changing pin size is the primary means of controlling wall thickness. To avoid incomplete mold closing the tube must, of course, be of smaller diameter than the bottle neck.

The effects of material temperature and extrusion speed complicate the adjustment of wall thickness. That these variables have an effect at all is due to two independent phenomena, strain recovery and drawdown. As the material is forced through the die the molecules orient in the direction of flow. When the material emerges the molecules tend to return to their original random configuration. This results in a shrinking along the length of the tube and a corresponding swelling in the thickness. This behavior is called strain recovery. Complicated time-dependent effects are involved, but *usually*, within the currently used range of conditions, increasing material temperature and decreasing extrusion speed reduce the effect. The thickness more closely approaches the die and pin clearance as material temperature is increased and extrusion speed decreased.

Drawdown is a self-thinning of the tube that is due to the pull of gravity as the tube is extruded vertically downward. As viscosity is decreased, either by increasing temperature or using a lower-viscosity resin, this effect becomes more pronounced. Fast extrusion speed minimizes the effect by reducing the time that the material is stressed.

Over the normal range of molding conditions, like changes in melt temperature and extrusion speed have opposite effects on strain recovery and drawdown, and, therefore, on bottle weight. Raising the melt temperature reduces the swelling of the tube due to strain recovery and increases drawdown and, consequently, reduces bottle weight and wall thickness as shown in Fig. 4, above. Increasing extrusion rate increases strain recovery and decreases drawdown, and therefore increases bottle weight. Fig. 5, above, illustrates the magnitude of this effect.

Figure 6, below, shows a plot of bottle weight versus apparent viscosity of the resin. The apparent viscosity was obtained from extrusion rates (at 44 p.s.i.) in the melt index apparatus at the temperatures at which the bottles were formed. It will be noted that the three 0.920-density resins gave data which formed one smooth curve with a distinct peak, while the two 0.950 density resins formed another lower curve that also seems to show a peak. This has triple significance. It means first, that the bottle weight obtained with a particular family of resins depends on the viscosity regardless of how it is attained (by changing temperature or molecular weight). Secondly, it shows that different types of resins give different bottle weights, even when compared on the basis of equal viscosity. Practically, this means that changes in pin size or molding conditions

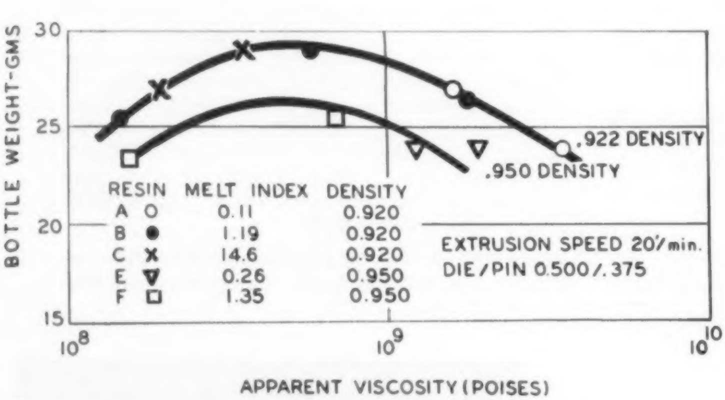
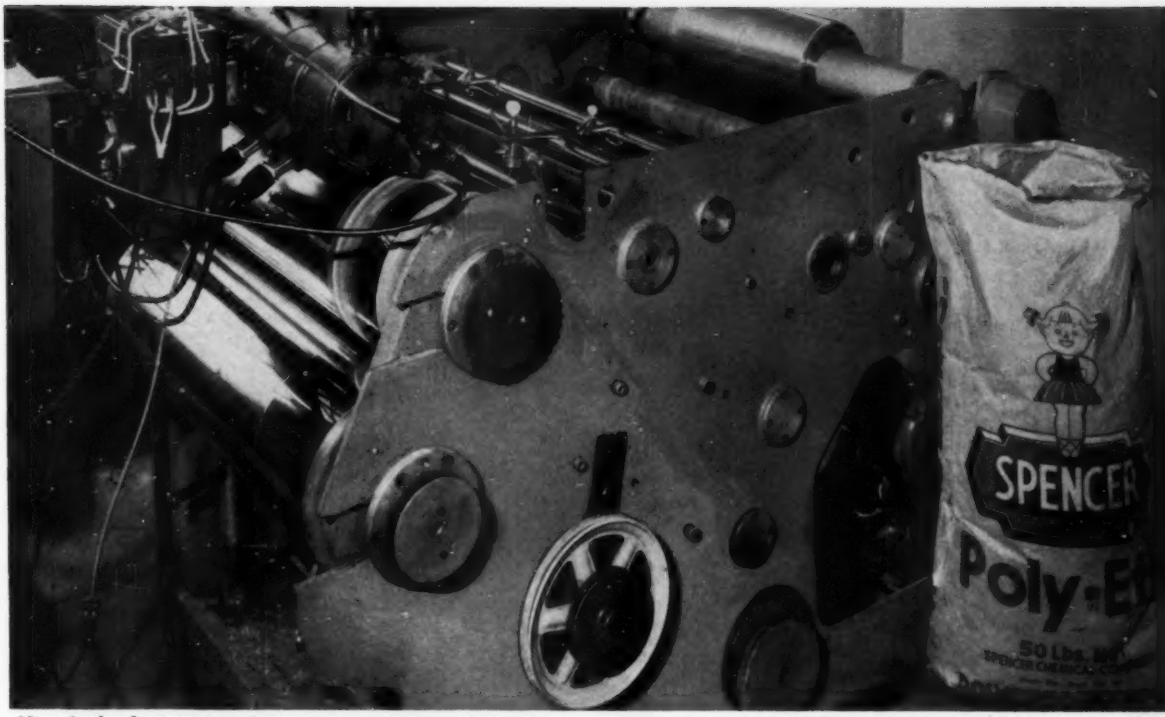


FIG. 6: Changing influence of time- and temperature-dependent factors, drawdown and strain recovery, linked with the melt viscosity, cause bottle weight to pass through maximum as viscosity increases. Resin structure has influence separate from viscosity effects. Note that, percentage-wise, none of these effects are very large, although they are large enough to be of economic importance.



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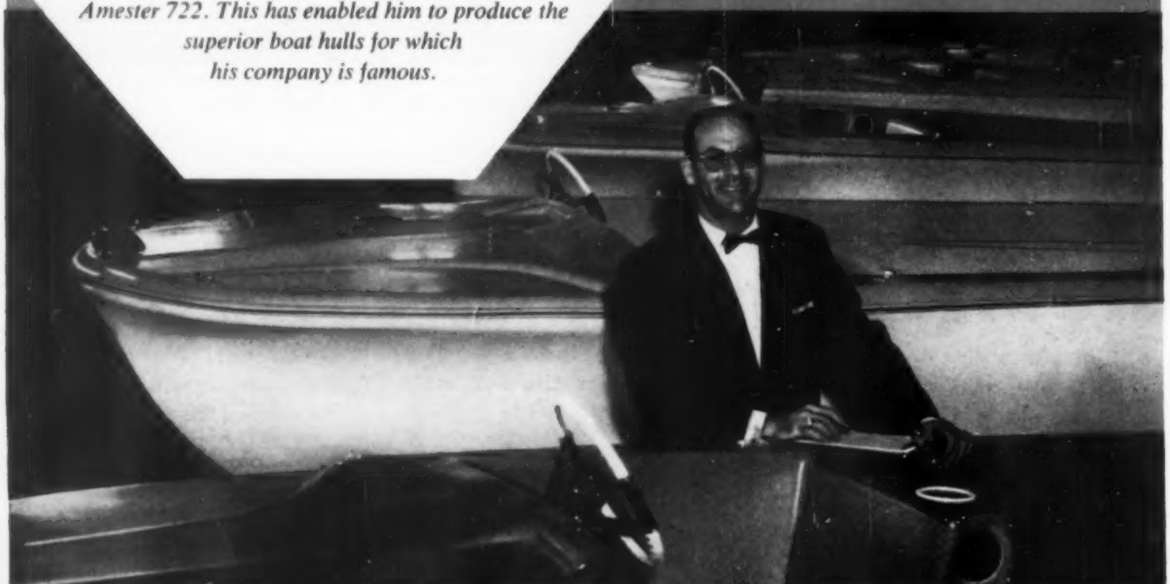

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may be required to maintain wall thickness when changing from one resin to another. This is an operating problem of the process. Finally, it shows that in the broad picture, changing the viscosity of the melt either by changing temperature or molecular weight can either increase or decrease the bottle weight depending on the value at the time of change. As was stated above, in the currently used viscosity range (to the left of the peak of the curves on Fig. 6) the usual effect of increasing material temperature (and thereby reducing viscosity) is to reduce bottle weight. If lower-melt-index materials or lower material temperatures prevailed the general rule would be reversed. The low melt index Resin A (MI = 0.1), for example, showed *increased* bottle weight with increased temperatures at all combinations of pin size and extrusion speed used.

There are both high and low limits on the viscosity of the melt which can be molded by the extruded tube method. The viscosity must be sufficiently low so that the tube can be formed in a short time without excessive pressure and roughness and yet not so low that the tube "runs away" because of drawdown.

The lower limit on apparent viscosity in the laboratory equipment has been found to be approximately 8×10^5 poises. When the viscosity is lower the tube runs away because of drawdown. Figure 7, above, shows an approximate plot of the temperature at which low-density polyethylene resins attain the "run away" viscosity versus the melt index. In the general case the value of the run away viscosity depends on the length of the tube being formed and the extrusion speed. The data in Fig. 7 are for a tube length of 8 in. and an extrusion speed of 15 to 20 ft./min. As the tube length is increased and the extrusion speed is decreased the tube runs away at higher viscosities.

It is interesting to note that if the data of Fig. 7 are plotted in a slightly different manner—inverse absolute "run-away-viscosity" temperature versus logarithm of melt index—the excellent straight line of Fig. 8, above, results. This finding is in perfect accord with the known flow/temperature behavior of polyethylenes. From this line it is possible to calculate that the activation energy of flow for these 0.920-density materials is slightly less than 11 kcal., in good agreement with values obtained from simple flow measurements. The closeness with which the "run-away-viscosity" temperature may be predicted from melt index indicates that this lower limit of viscosity is very sharply defined—a finding that was verified in the blowing experiments and gave this limit its "run-away" name.

Minimum cooling time: The slowest-cooling portions of bottles blow molded using the extruded tube method are the neck sections and the "tail" at the bottom of the mold where the seal is made. These sections are thicker than the bottle wall since the neck undergoes relatively little expansion and the tail is not blown at all. Depending on the handling method of the ejected pieces the minimum cooling time is set by one or the other of these areas.

If the piece is ejected too quickly the heat retained in the thick neck of the bottle will soften the shoulders and the neck will droop. Or, if the pieces are allowed to fall on top of one an-

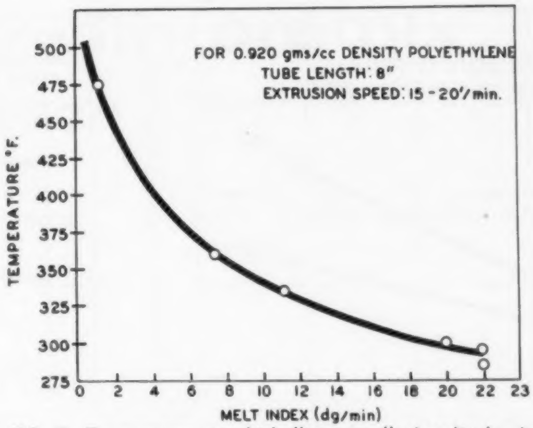

FIG. 7: Temperature at which "run-away" viscosity is attained depends inversely on melt index of the resin.

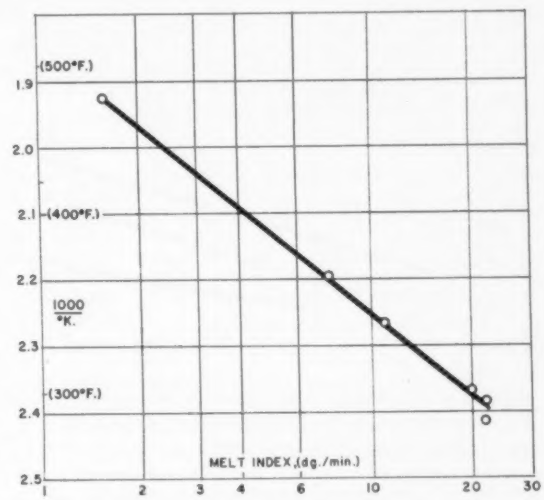

FIG. 8: Conventional flow temperature plot of "run-away-viscosity" temperatures of Fig. 7 demonstrates very close relationship between viscosity during drawdown (in tension) and during flow through melt-indexer orifice (in shear).

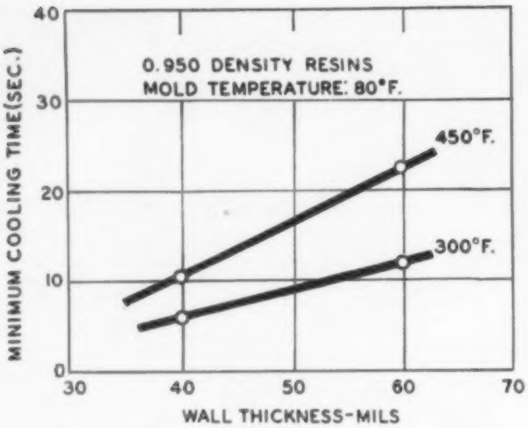

FIG. 9: As would be expected, cooling time required to attain self-supporting stiffness increases with increasing wall thickness.

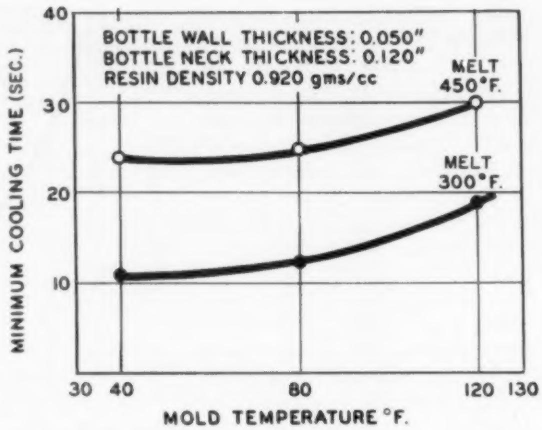

FIG. 10: As mold temperature increases at constant melt temperature and wall thickness, temperature differential for cooling and cooling rate drops; minimum cooling time increases.

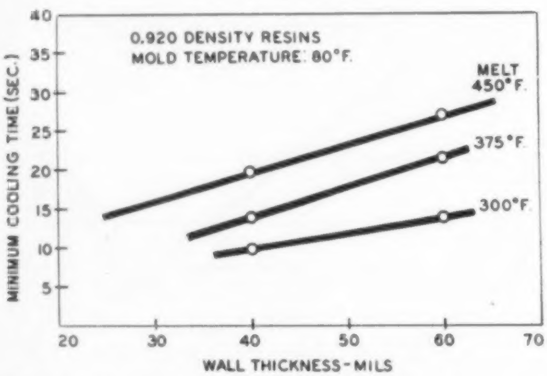

FIG. 11: Minimum cooling time, which would be zero at zero wall thickness, varies almost linearly with the wall thickness of the piece being molded.

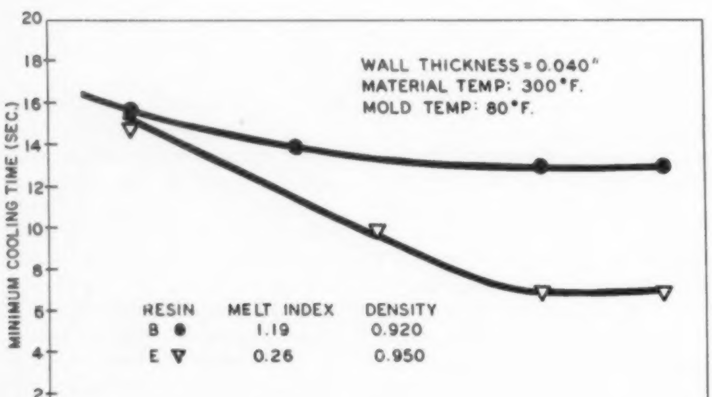

FIG. 12: Cooling time diminishes with increasing air pressure up to the point (at approximately 60 p.s.i.), at which pressure is sufficient to maintain a good contact between bottle walls and mold surfaces throughout entire cooling period and cooling time no longer changes.

other, it will be necessary to cool sufficiently long so that the "tail" will also be cooled so as not to distort or stick to the bottle it falls upon. In both cases it is found necessary to cool longer than required on the basis of wall thickness alone. Despite this and the fact that cooling takes place from one side only the cooling cycles in blow molding are in the same range as in injection molding for equal wall thickness and faster based on maximum section thickness. This is made possible by the substantially lower temperatures used in blow molding.

In the laboratory studies the minimum cooling time was judged by placing the freshly ejected bottle on its side and observing whether or not the neck drooped. The expected qualitative results were obtained. Minimum cooling time was decreased by 1) Decreasing mold temperature; 2) decreasing melt temperature; 3) decreasing wall thickness; 4) increasing blowing air pressure. The advantageous effect of the higher air pressure is to keep the shrinking material in contact with the mold wall for better heat transmission.

Some of the quantitative data are presented graphically in Figs. 9 to 12. The data refer specifically to bottles of the geometry shown in Fig. 2. To obtain estimates of cooling time for other pieces, the neck thickness should be calculated from the **(To page 218)**

Problems with premix molding—Part 2

Cracks and what to do about them

By R. B. White[†] and R. S. Jackson[‡]

Unexplainable, unpredictable cracks in otherwise perfect plastic parts can be exceedingly demoralizing to the reinforced premix molder and his customer. While cracks in these materials are commonly only superficial and have no important effect on the strength of the parts, the threat they imply is reason enough to make such parts unacceptable in most applications. Even when small cracks could be accepted, the problem of agreeably defining a "small" crack may be insurmountable. The high cost of eliminating all cracks, whether large or small, may make it seem wise to accept small ones in a given part. But what is, or is not, a "small" crack? The only satisfactory answer to this problem is to mold crack-free parts, but this is usually easier said than done with glass/premix moldings.

Some of the reasons for the common occurrence of cracks in glass-fiber-reinforced premix materials will be found in the explanations of strength variations and internal void problems given in Part 1 of this article.

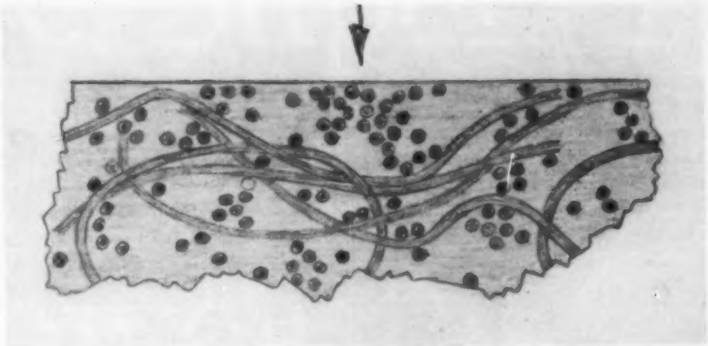

FIG. 16: Schematic cross section of material found near the surface of a molded premix part giving highly enlarged view of the bundles or "strands" of glass fiber lying within the polyester matrix which they reinforce. The strings indicate strands lying in the plane of the cut and the circles show the grouping of strands running at right angles to the cut face. Note how a heavy grouping of parallel fibers such as seen under the arrow in this illustration will be quite vulnerable to any stress at right angles to this group of fibers.

Generally speaking, these cracks occur where groups of fibers are found lying parallel to each other at some point on the surface with no interlocking or cross fibers close enough to carry the crosswise stresses at that point (see Fig. 16, above). As the resin matrix shrinks during the cure of this part, the longitudinal strands seen lying in the plane of the section will resist this shrinkage. Since transverse strands cannot provide strength in this cross direction, a crack may occur, running parallel to the strands. This view also shows why such cracks normally cannot propagate far into the mass of a molded piece.

Weld-line cracks

Weld-line cracks are probably the most serious threat to strength of parts since they frequently extend through the entire thickness of the piece along the weld-line. Even a very small crack along the surface of a weld line may easily become extended under stress through the entire section because there is likely to be very little interlocking of reinforcing fibers across the interface, or weld line, where two masses of compound flow together from different directions in a mold.

A very common weld-line problem occurs in parts with side-draw holes, or vertical-draw holes located at positions which require the compound to flow around the core pins as it fills out the mold.

This latter condition is illustrated in the flange-mounting hole of the hollow post-insulator of Fig. 17, left. This cracked molding was made with the ball-charge molding technique described in Part I of this article. We found that the doughnut-charge technique developed to improve shoulder strength in this part practically eliminates this weld-

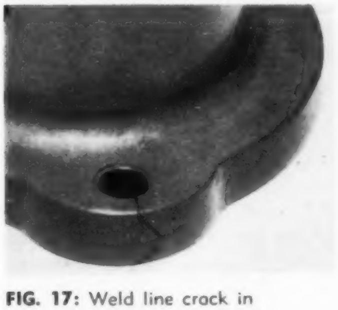

FIG. 17: Weld line crack in bolting flange of molded premix part as caused by failure of compound flowing around core pin in mold to knit together at far side. Actual cracking of this kind can usually be avoided in such parts, but the weakness exists nevertheless, unless the molding technique precluded the occurrence of the weld altogether.

†President and ‡Chief Engineer, The Glastic Corp., 4321 Glenridge Rd., Cleveland 21, Ohio.

For Part I of this article, see Modern Plastics, March 1959, p. 117.

line cracking also. The core pin which is mounted on the force actually pierces the doughnut charge of compound as the mold closes, eliminating the meeting of flow fronts.

In many applications, where it is impractical to arrange for the force to pierce the charge in this manner, the part design may be changed from a closed hole to a C- or U-shaped hole which simply eliminates the weld line altogether. (This design is exemplified by the bus insulator that was shown in Fig. 6 of Part I of this article.) A solid-molded flange with holes drilled after molding is the strongest construction—also the most expensive.

An interesting case of weld-line cracking will be seen in Fig. 18A,

FIG. 18A: Pull out ring molded around tubular insert illustrates a difficult weld line crack problem since there is no possible way to mold such a part without flowing the compound around the insert, and the high shrinkage stresses which develop around a large insert of this kind are frequently too much for the relatively weak structure that exists at the weld line.

FIG. 18B: Advancing fronts of glass premix compound just before "welding" show slight toothiness due to fibrous composition, but this is not nearly sufficient to create full strength values in the weld line.

below. In this application, tests proved that the part provided adequate strength even with a fully open crack all along the weld line (the pull ring always breaks before the tube enclosure fails). But the ultimate consumer can hardly be expected to have confidence in molded parts so visibly cracked at a point of stress.

Proper compound formulation can greatly improve the weld-line strength in a part like this, first by creating "toothiness" in the advancing fronts of material as seen in Fig. 18B, and second by selecting resin/catalyst systems which will react effectively together across the face of such a weld line.

Even with the best of control, however, such parts are bound to crack under fairly low physical loading, and elimination of cracked parts by inspection at the molding plant will not provide an acceptable answer. Since these parts will still sustain the required load even though cracked, customer confidence can be ethically preserved if these cracks are artfully made part of a "busy" pattern in the crack area. Such a solution is sketched in Fig. 18C.

Long-flow cracks

Another common form of crack which is closely related to the weld-line crack is found around large, deep inserts, where the amount of material around the insert or pin is limited, and more especially, where it has to flow from another part of the mold into the critical area. Typical long-flow cracking is illustrated in Fig. 19A, p. 121. Radial cracks like this one were sporadically causing high rejections in production lots of this molded stud. A theory that this trouble might be due to a flow problem was explored by making a large number of experimental moldings in which the flow was arrested in various stages of the mold closure. After over 100 such trials, the part illustrated in Fig. 19B, p. 121, showed up, and while this was only a single part, the conclusion became almost inescapable, especially after more careful re-study showed an occasional repetition of this condition.

Cracks in the area illustrated

FIG. 18C: "Busy" design in weld line area conceals crack, in application where only problem is appearance.

were due to a weld-line condition which resulted from uneven flow of the compound up along opposite sides of the long steel insert. This uneven flow caused the compound to reach the top of the mold on one side first, and thence to move around the insert in both directions with an opposing sort of wave action which would meet in a short knit line at the far side, as illustrated in Fig. 19B. In such a part, the weakness of the weld line is made even worse by the partial curing which occurs in the "front" material during its long travel before meeting an opposing front.

In this part, the best solution was found to be a combination of several changes: 1) redesigning the insert to provide steps as seen in Fig. 19C; 2) careful preform shaping to insure filling the full diameter of the cavity so that the force would pierce into the true center of the charge; 3) a carefully controlled press-closing speed to allow the compound to come up evenly on all sides of the insert without precuring before the closure is completed; 4) preheating the inserts to about 20° F. above mold temperature to permit thermal shrinkage of the insert and thus help relieve the stresses in the plastic; and 5) reformulate compound to include a more flexible resin and precipitated carbonate filler instead of ground mica.

Non-round cores

Figure 20, p. 121, illustrates a somewhat different core-pin problem. Cracks in the center boss at the sharp corners **(To page 121)**

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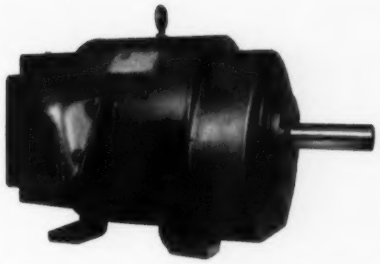

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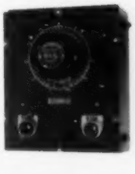

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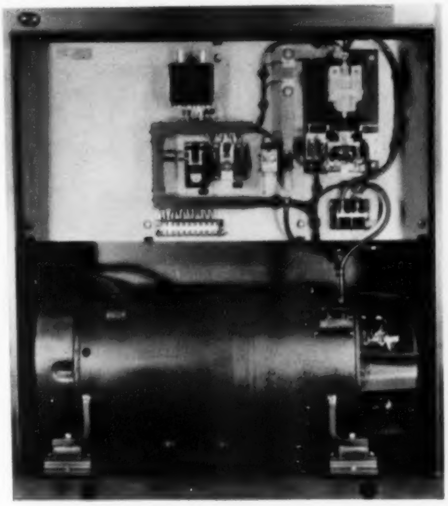

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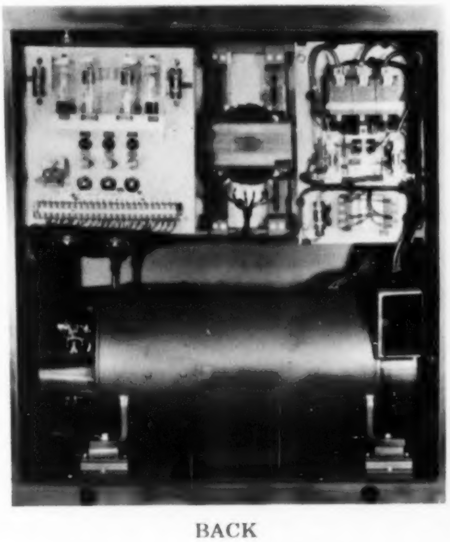

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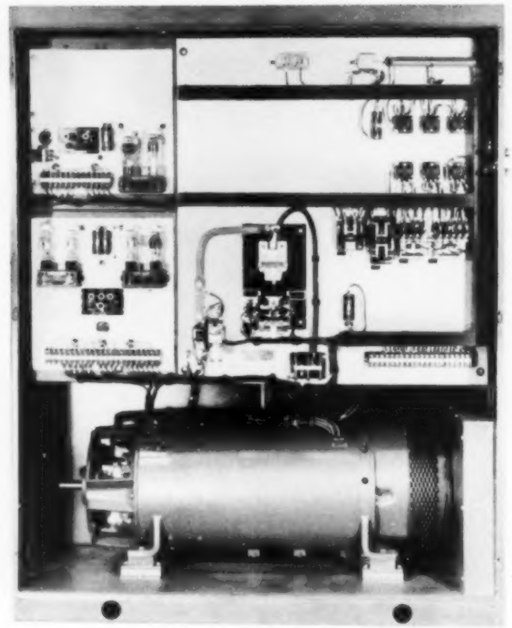

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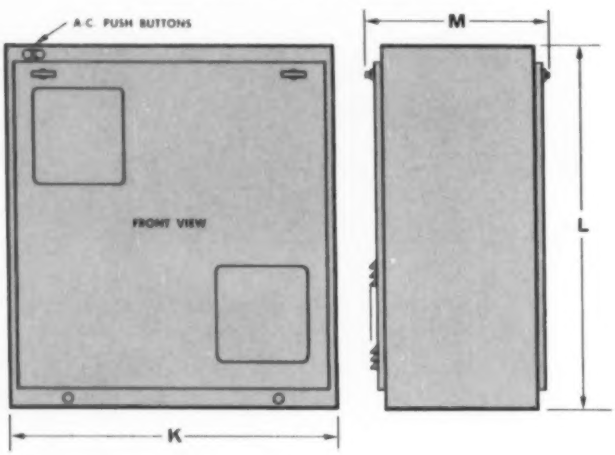

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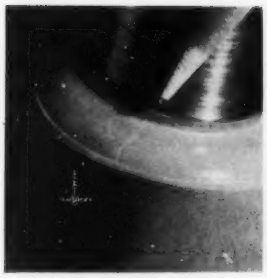


FIG. 19A: Typical crack in rim of this deep, long-flow molding. (This part does not have the tapered insert seen in Fig. 19C.)

FIG. 19B: Weld line forming in compound just before final closure explains cause of crack seen in 19A.

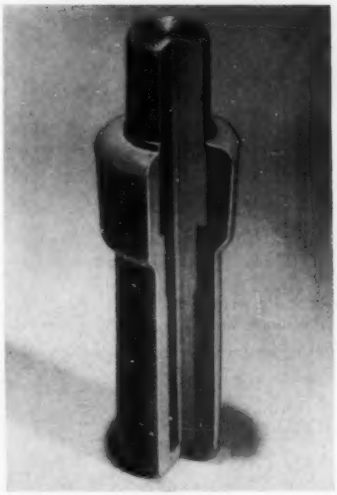


FIG. 19C: Long flow path of compound is a necessity in molding this stud since the glass premix charge first becomes compressed in the bottom of the mold by the descending insert before flowing up along its sides. Note tapered and shouldered design of insert which helps prevent the compound from rising unevenly on opposite sides of the mold.

of the square opening constituted a severe problem at the outset of this job, and in this case were functionally completely unacceptable because this part had to perform as a dielectric barrier when pressed tightly onto a square insulated shaft.

In this case, the causes explained above could hardly apply, since the compound does not have to flow very far to fill the boss around the opening.

This problem is apparently related to the shrinkage behavior of the compound and the stress concentration which occurs with such a design; accumulated tensile stresses from two perpendicular planes are concentrated at the corners of the large square opening, whereas with a round hole these stresses would be distributed fairly evenly around the periphery.

It was found that accurately short-timing the cure cycle and removing these parts from the mold "green", i.e., before the cure is quite completed, eliminated these cracks, apparently because the final cure, and final shrinkage, could take place without the core pin in place to resist this shrinkage. To allow for the added shrinkage after the pieces came out of the mold, the square cores were plated to a slightly larger width.

This technique, which can be a very useful device in controlling core-pin-crack problems, requires an exact control of the catalyst behavior in the compound. Regardless of the accuracy of timing of the molding cycle, variability in cure *rate* will result either in undercured parts which may stick in the mold or may not be strong enough to prevent ejector pins from pushing into and damaging them, or conversely, in fully cured parts with cracked corners. Variations in the cure rate can result from such things as the differences in resin reactivity which must be expected from batch to batch and from time to time, depending on the extent to which the inhibitors normally used in these resins may have been used up during the storage period of the resin used in the mix. Further sources of variability in curing behavior can arise in the mixing operation—in the heat-up of the mix or the cooling procedure after mixing—in storage time/temperature factors, in the inhibiting effects of pigments and fillers, in evaporative loss of styrene during mixing, storage, and handling at the molding press. Aids in controlling such factors include exotherm curves on compounds themselves and on the resins used to make them, monitoring the reactivity effects of fillers and pigments, making cure tests such as the modulus-evaluation method described by A. D. Coggeshall, Pl. Tech. *4*, 51, January 1958, and, finally, watching the compound behavior in the mold itself for any recognizable trouble symptoms.

Web cracks

Wherever in the molding the compound is required to flow together from two directions to fill out a web or boss, there is danger of cracking behind the web illustrated in Fig. 21, p. 122. This is apparently due to lack of interlocking of the reinforcing fibers at the point where the two streams of material are required to flow around the corner and down into the web alongside each other. This can be controlled by careful compounding for minimum shrink and maximum toughness in unreinforced areas. For example, it is helpful to use resins

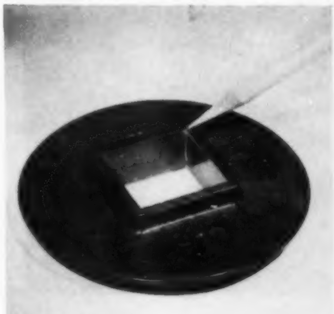
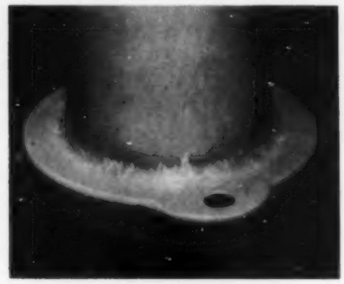


FIG. 20: Molded flange with square cored hole gives stubborn trouble with fine cracks at corners.

FIG. 21: Fine flow cracks frequently develop opposite webs and bosses as revealed by penetrating dye on the back side of this fan. Inset shows front view in smaller scale.

FIG. 22: Exaggerated case of "radius marks," pseudo cracks which mysteriously appear at small radii in certain parts. No physical weakness is observable in spite of distressing appearance.



with high hot strength and some resilience, and to include more filler to reduce shrinkage.

"Radius marks"

This is a special phenomenon that looks like cracking and frequently occurs on inside radii of molded glass premix parts. Such marks are very disconcerting in appearance, although it is hard to detect any evidence of physical or electrical weakness in radius-marked areas. When such parts are stressed to failure, the final break appears to be uninfluenced by these mysterious marks, and will frequently occur directly across them or right alongside them without breaking them open. They show no tendency to progress or enlarge under physical loading. No difference in electrical breakdown values has been observed between parts which display these marks and parts which don't.

These marks appear to occur most commonly on the surface of inside radii of ⅛ to ½ inch. Figure 22, above, is typical. A solution can usually be found in the empirical selection of a different compound or making the radii smaller or larger. In the case illustrated a change from ½- to ¼-in. reinforcing fiber and from a highly cross-linked resin to a less reactive, lower-hot-strength resin corrected the trouble.

Tenderness

A different kind of strength problem encountered in premix molding is known as "tenderness," the tendency of certain parts to develop surface cracks under loads far below the ultimate strength of the piece. Where appearance is important, tenderness can be disastrous, and it became a real headache in a door frame for an airlines food oven. Since both impact and heat resistance were wanted, polyester-glass premix seemed well suited to the job, and in testing it performed well, except for shallow surface cracks (see Fig. 23A, below), which often appeared after mild bumping of the oven. Such low-stress cracking has been studied in some detail by Chambers and McGarry, ASTM Bulletin No. 233, p. 40, Oct. 1958, and also by A. D. Coggeshall (*op. cit.*). Using shorter glass fibers in the premix, or incorporating some

FIG. 23A: (left): Surface crack in food-oven door frame. Penetration of this crack is probably not over 0.025 in., and effect on ultimate strength of the section would be indetectible. But the effect on the mind of the user is plainly detectible, especially after a little dirt has worked into the crack.

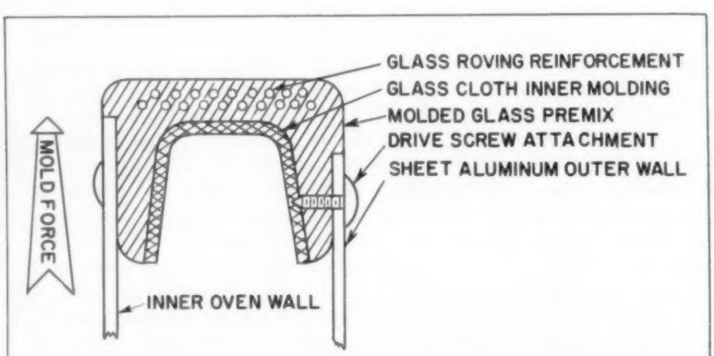


FIG. 23B: (right): Cross section through oven-door frame, showing reinforcement technique adopted to avoid "tenderness" cracks.

Dow Plastiatrics

DOW'S CLINICAL APPROACH TO HEALTHY PLASTICS APPLICATION

NEW EPOXY SYSTEM MAKES ADVANCED TV TUBE DESIGN PRACTICAL

DOW DEVELOPMENT CAPITALIZES ON EPOXY'S GLASS ADHESION, STABILITY, CLARITY

A leading TV tube manufacturer recently presented Dow with a problem involving the laminating of glass panels. They had developed an advanced design for a square-face TV tube which required the laminating of a contoured implosion safety panel directly to the face of the tube. The design would provide greater safety against implosion, produce a brighter picture, eliminate the conventional, dust-catching, separate safety panel and permit the building of slimmer sets. To accomplish this, the manufacturer required a special laminating system and resin material which would meet the following requirements:

1. The method must be adaptable to mass production.
2. The method must provide a stable, adhesive bond to glass.
3. The resulting laminate must be able to withstand rough handling.
4. The resulting laminate must be able to withstand extreme changes in humidity and temperature.
5. Resulting optical properties must be acceptable by E.I.A. color standard for television.

Because no available resin met all these requirements, Dow had to develop a special system which would solve the problem.

Dow's prior extensive research and development work on epoxy resins, coupled with Dow's basic raw material position, had produced new resins whose properties appeared to offer promise of fulfilling the stated requirements. Among these resins were several which were known to: provide high-strength bond to glass; produce stable, heat-and-shock resistant laminate interlayer; exhibit nearly water-white clarity after cure; cure quickly at relatively low temperatures.

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D.E.R. 667— Nearly water-white—Maximum hardness
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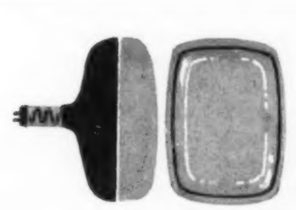
Dow Epoxy Novolacs

Thermosetting epoxy resins for high temperature use—up to 500° F.

*Trademark

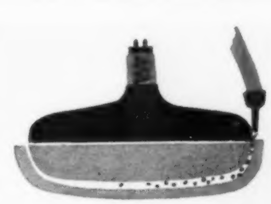
Working closely with TV engineers and manufacturers of automatic blending and dispensing equipment, Dow chemists and technical service engineers tailored a unique epoxy system which met every requirement for successful mass production of the new square tube.

Plastiatrics studies, like the one described above, are part of a continuing program by Dow Coatings Technical Service engineers to aid Dow customers in the selection of coatings materials, and in technical matters relating to manufacturing techniques. For more information on Plastiatrics studies, write THE DOW CHEMICAL COMPANY, Midland, Mich., Plastics Sales Dept. 2377CS5.



Panel and tube faces are cleaned and preheated (150-200° F.)

Preheated parts are assembled and positioned properly.



Resin system is automatically injected, cures to handle in fifteen minutes.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

flexible resin can help in some cases of tenderness, as will metal inserts in critical areas. In this case, the best all-round solution to the problem was the composite section sketched in Fig. 23B.

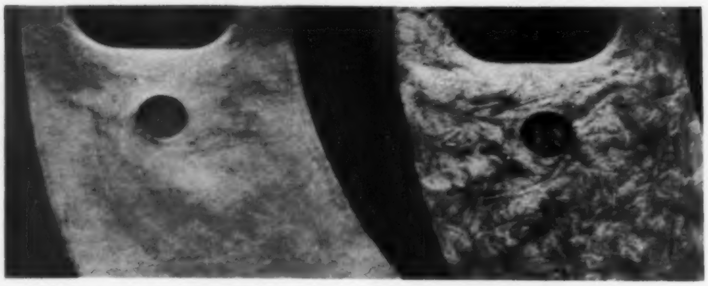


Fig. 24A (left) & B: Surface of molded part made from standard "garden variety" glass/polyester premix, **(A)** before, and **(B)** after heat aging (200 hr. at 150° C.) Note how darkening and volatilization of resin have exposed pattern of glass reinforcement.

Aging cracks

An annoying feature of almost all cracking problems with these materials is their cantankerous habit of not appearing until after the first beautiful samples have been grabbed out of the mold and air-expressed to an eagerly waiting customer.

Apparently internal stresses can exist in these materials after curing which are high enough to produce cracks but low enough not to do so immediately after molding. Generally, if such delayed cracking does not occur within a day or two of molding, it will not occur at all. (There is no evidence that the polyester resins tend to go on slowly curing further and shrinking further for weeks or months after molding as do condensing resins, such as phenolic and melamine.)

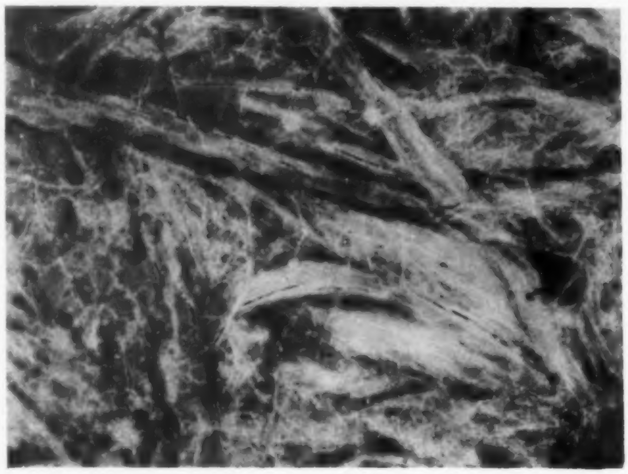


FIG. 24C: Enlarged view (10X) of portion of surface of the heat aged part seen in Fig. 24B shrinkage cracks in resin rich areas and running parallel to bundles of glass fiber reinforcement. Proper formulation of compound can prevent cracking of this kind.

Heat-aging cracks

If molded glass-polyester parts are subjected to prolonged exposure at 250° F. or higher, crazing and cracking may occur because of volatilization of low-molecular-weight material from the cured resin, and volatilization of any aldehydes, alcohols, or acids which may form through oxidation of the polyester resin at the temperature involved.

Figure 24, above, shows an example of such cracking. The extent to which this occurs is markedly affected by the characteristics of the particular resin used in the premix formulation, as well as kind and quantity of filler used. General-purpose, styrene polyesters, for instance, are much less satisfactory than diallyl phthalate alkyd compositions. The extent of atmospheric exposure involved is also an important factor. Decomposition of surfaces which are tightly clamped under metal plates, or immersed in oil, or protected by a heat-resistant silicone varnish is much less rapid.

FIG. 25: Transfer molded part treated with penetrating dye to show up circular pattern of cracks around sprue opening. Section view shows how same pattern of cracks extends into the body of this part. (Note large ⅜ x ¼ in. gate opening used to avoid damage to glass fiber reinforcement.

Thermal shock

Generally speaking, glass-reinforced polyester parts are very resistant to even the most severe thermal shock conditions, such as plunging parts directly from a 200° F. oven into a −100° F. acetone bath. However, if incipient crack weaknesses exist, like the weld-line areas described above, severe thermal shock will induce cracks to occur in otherwise sound-looking pieces. In this connection, care must be taken not to set up a test requirement which is wholly unrealistic in terms of actual **(To page 220)**

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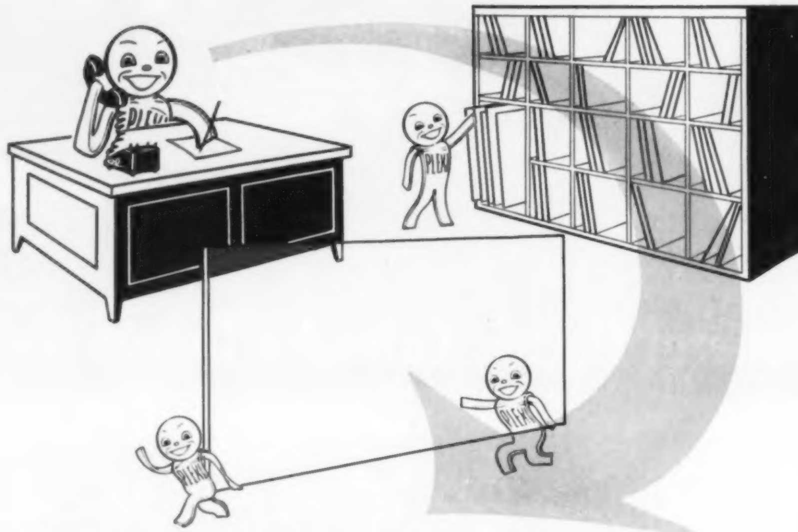

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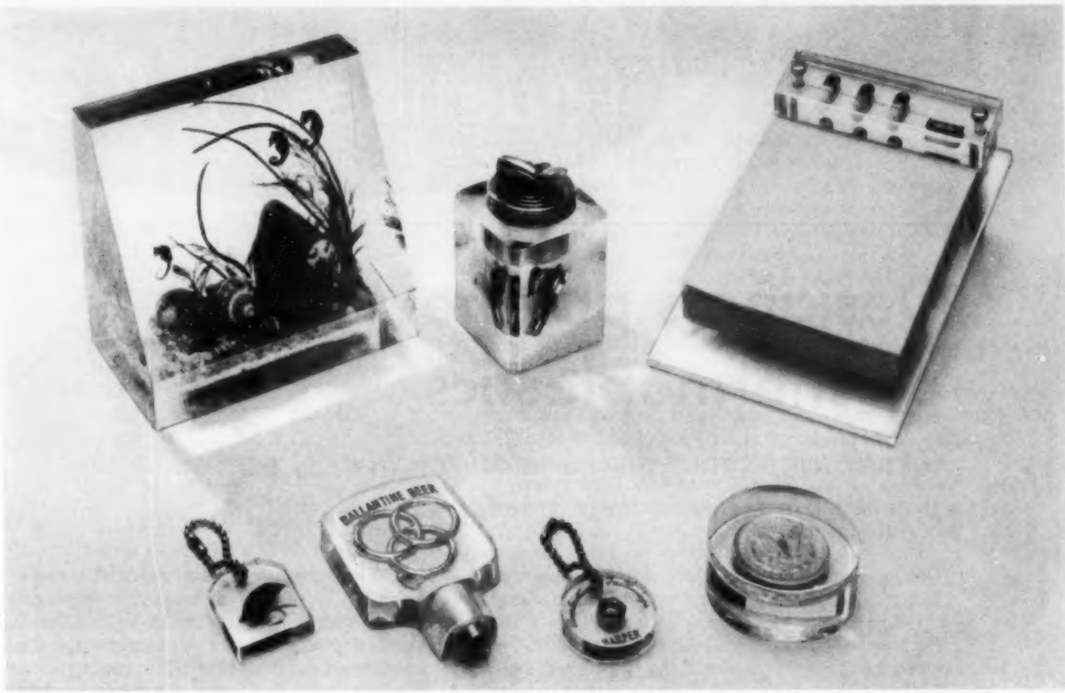


FIG. 1: A few examples of the many cast acrylic products which are surfaced on abrasive belt grinders: book-end, lighter, specialty calendar pad stand, key tags, beer-tap knob, commemorative item.

How to save time and get good control of finish, flatness, and interfacial angles of acrylic castings by

Wet-belt grinding

Grinding and finishing are important operations in the manufacture of acrylic castings for industrial users (clock cases, brush backs, etc.), and embedments used as beer-tap knobs, advertising specialties, and gift items (Fig. 1, above). First, most such castings shrink substantially and unevenly as polymerization proceeds, resulting in "sinks" or shrunk-in faces. If these shrunk-in faces of embedments were not ground flat, the embedded objects would seem grossly distorted to the viewer. Second, many embedments are designed to take advantage of internal reflection from highly polished acrylic surfaces to provide multiple views of the embedded objects; for these, aside from flatness and polish, there must be close control of the angles of intersection of the various faces of the block if the most pleasing sizing and spacing of the reflections is to be achieved. Third, final polishing is considerably easier if the preliminary grinding leaves the faces with a fine and uniform finish.

To meet all these requirements —with a minimum of set-up and grinding time—Clearfloat, Inc., Attleboro, Mass., uses platen-type, abrasive belt grinders[1].

Each of the grinders is equipped with an automatic infeed table that allows for a two-speed infeed sequence; the block approaches the belt at high speed, then is ground at a hydraulically controlled lower speed. A micrometric stop regulates the amount of infeed travel to a preset tolerance, thus determining the thickness to be ground off (Fig. 2, p. 130).

Simple fixture blocks are used with this table to reduce the time required for changeover, set-up, loading, and unloading. Before the grinding run begins, a solid fixture block is cast from acrylic resin, using a sample of a casting that is to be ground to form a cavity in the fixture block. After the block has set, the "pilot" casting is removed and the block, positioned against an angle plate (Fig. 3, p. 130), is ready for duty as a fixture. For small castings such as key tags, a single block is made to hold **(To page 130)**

[1]Grinders are Model BG8/FT9, made by Engelberg, Inc., Syracuse, N. Y.

HERCULES

Plastics Hi-lites

Designers put the heat on thermoplastics

Greater temperature and chemical resistance of newer materials proves a big factor in their growing use

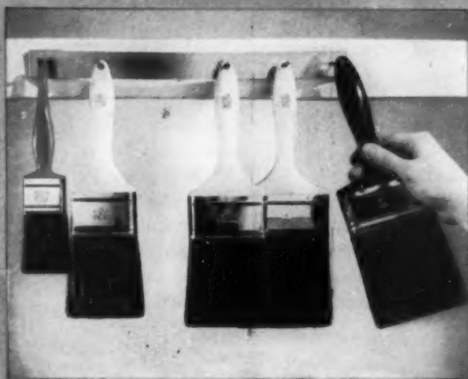
Designers are putting thermoplastics to work today in jobs where no one would have dreamed of using them a few years ago. In many instances, the better resistance to heat and chemicals provided by the newer materials has made it possible to design better looking, more functional products, at lower unit costs. Savings may lie in a number of different directions: cheaper processing, lower material costs, reduced shipping and handling charges, less breakage, or longer shelf life. But above all, it's the styling possibilities of the new plastics that most intrigue the designer, and are stimulating him in the conception of new plastics products, many for markets previously the exclusive domain of other materials. Here are some exciting results of this new trend in design.

STYLISH AND SANITARY . . . A new all-plastic carafe and tumbler set provides a timely answer to the unfavorable publicity about unhygienic bedside hospital water. Manufactured by Zylon Products Company of Pawtucket, R.I., the set consists of a wide-mouth carafe with removable lid, a disposable plastic liner, and a matching tumbler. Carafe, lid, and tumbler are all made with Pro-fax®, Hercules polypropylene, and the plastic's high heat resistance makes it possible to autoclave the entire unit at the termination of a patient's stay. Daily replacement of the low-cost disposable carafe liner insures a clean water supply at all times without daily carafe sanitizing.

BETTER LOOKING AND SAFER, TOO . . . This new Prak-T-Kal vaporizer-humidifier is virtually unbreakable, easy and safe to handle and store. Molded with Pro-fax, the colorful, handsomely styled bowl and lid of this new unit cannot rust, discolor or corrode—advantages provided by this new polypropylene plastic. An automatic shut-off that cuts the current to the heating element before water is completely used, makes it safe to leave this unit unattended even in a child's room. Bowl and lid for the unit are molded by Jamison Plastics, North Bellmore, Long Island, N.Y., and manufactured and distributed by Practical Electric Products Corp., Long Island City, N.Y.

Pro-fax gives wood the brush-off

Pro-fax replaces wood in this new line of TUFLITE paint brush handles, providing a superior product at lower material and production costs.



Pro-fax gives TUFLITE handles in the popular Beavertail style all the merchandising features important in the fast-growing "do-it-yourself" market.

TUFLITE handles are lighter and more durable than wooden models, have a finish that is impervious to solvents, and will not crack, chip, peel, or wear off. Available in a rich array of handsome colors, they are the first plastic brush handles offering colorful styling in a low-cost product.

Not only lower in original cost, TUFLITE handles also cut the cost of brushmaking. Unaffected by humidity changes, they speed handle assembly, eliminating rejects due to shrinkage or swelling.

TUFLITE paint brush handles manufactured by H. V. Hardman Co., Inc., Belleville, New Jersey.

Hi-Fax® serves soap in style

A handsome globe molded with Hi-fax, Hercules high-density polyethylene, makes Bobrick's new line of soap dispensers an attractive asset to any washroom. Much safer, too, since the globe won't crack or shatter if dropped when being refilled. They have a soft lustrous snow-white finish that's easily kept like new by simple damp-cloth cleaning. Bobrick selected Hi-fax after testing other materials for durability and resistance to chemicals. Globes are blow-molded by Olympic Plastics, Inc.

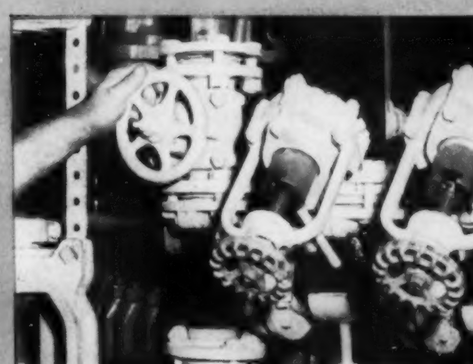
Design Hi-lites

From a designer's standpoint, a new spectacle case molded by Parmalee Plastics for U. S. Safety Supply Company is one of the most exciting uses of Pro-fax seen to date. The cover, hinge, case, and latch are all one piece of Pro-fax molded in a single shot, in a cleverly designed mold. A true plastics paradox, the case and cover depend on the *rigidity* of Pro-fax in achieving a durable, protective package for a delicate product, while at the same time the molded hinge relies on the *flexibility* of Pro-fax in thin-wall sections. If that weren't enough, the resilience of Pro-fax makes possible a strong, snug-fitting latch, which nonetheless releases readily under delicate thumb pressure.

Using the same basic idea, a variety of other such Pro-fax packages suggest themselves for products like cosmetics, tools, toys, or personal goods.

40 months' resistance to corrosive acids

Here's a "proved-in-action" case history of Penton®, Hercules chlorinated polyether—the new thermoplastic polymer with exceptional resistance to corrosion at elevated temperatures. The valve at left in this photograph is a Hills-McCanna diaphragm valve with a cast iron body lined with Penton. It is continuously exposed to carbon



tetrachloride, hydrochloric acid, and wet chlorine at temperatures up to 85°C. The valve has operated in this highly corrosive system since September 29, 1955 without a single failure in over forty months. Indicative of the corrosive atmosphere is the use of Haveg, glassed steel, porcelain and Pyrex for other valves and piping in this system. To learn more about Penton in valves, pipe and fittings, pumps and meters, flame-sprayed or whirl-sintered parts, write to Hercules for your copy of "The ABC's of Penton for Corrosion Resistance", and the technical brochure on Penton's properties and uses.

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several parts. Another fixture, a toggle-clamp holding angle fixture (Fig. 4), accurately positions beer-tap knobs for grinding of the knob shank to an angle.

Step-by-step

The parts are first rough ground on a 9- by 107-in., 36-grit silicon carbide abrasive belt, followed by two subsequent grinding operations on 100-grit and 240-grit belts of the same size and material. Amount of stock removed ranges as high as 3/16 to 1/4 in., and the parts take on the fine, uniform finish necessary for final polish. Belt speed in all operations is approximately 3500 ft./min. Backing the belt is a 9- by 12-in. platen of tempered, air-hardened steel, reversible and adjustable so as to give maximum service life. Grinding is done wet with all grits; water containing rust inhibitor is applied directly to the grinding area. In addition, coolant is sprayed against the belt inside the machine to keep the cutting grits free of resin. Because of this built-in coolant/cleansing system, belt life is excellent.

During the grinding cycle, the table is oscillated to utilize the full width of the belt and insure even distribution of wear. Belts can be changed in about one minute.

Rapid stock removal, fine surface finish, flatness, control of face-intersection angles, and short-run flexibility are more important in this operation than precision tolerances. However, smaller parts—cuff links, for example—are held to ±3 mils without difficulty. Production rates vary from an average of 250 beer-tap knobs per hour to 750 per hour on smaller castings such as key tags and cuff links. Changeover time from one product or operation to another is very short.—**End**

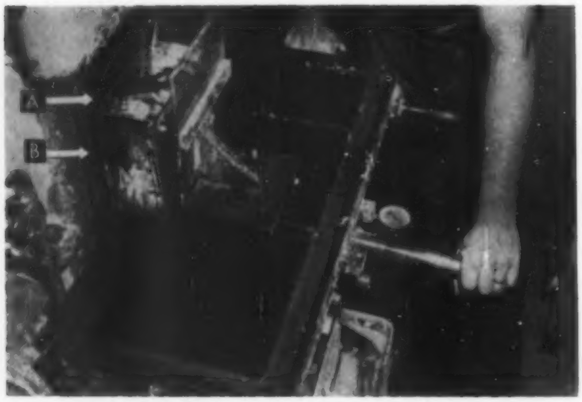
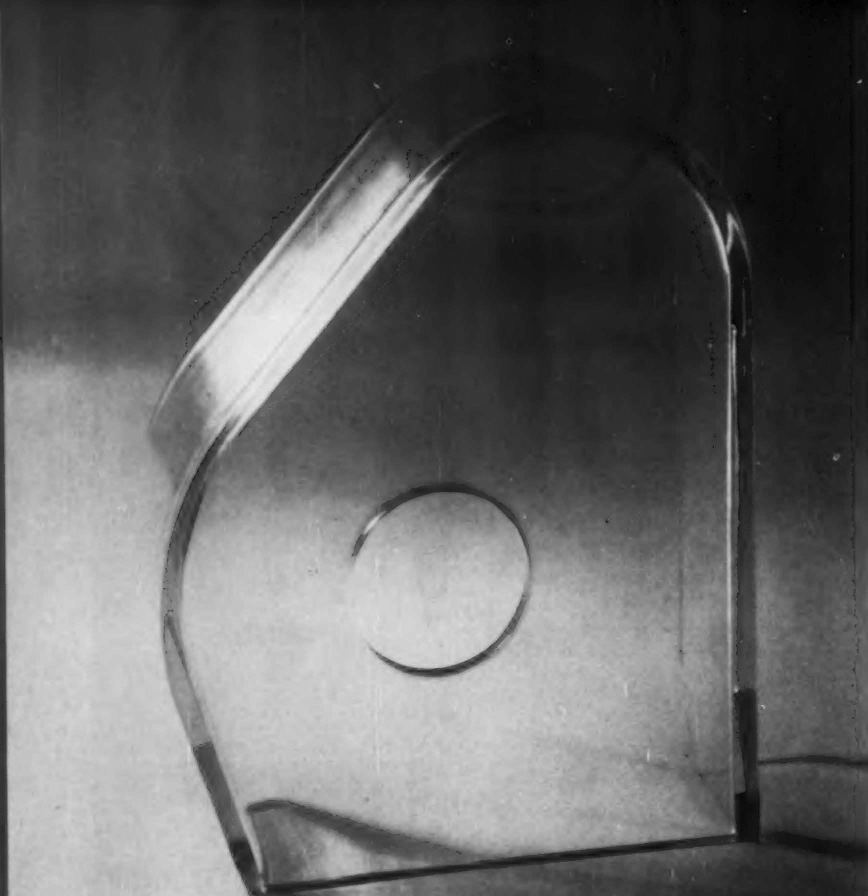


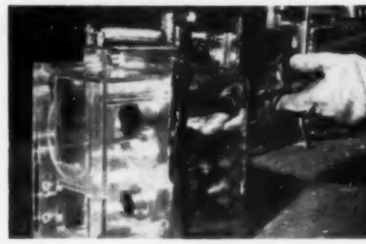
FIG. 2: Automatic infeed of abrasive belt grinder (A—belt, B—back-up platen) carries work against belt until preset stop is reached. Dial (center) is micrometer indicator.


FIG. 3: Solid cast acrylic fixture block (right) is used in conjunction with angle plate to hold work piece (beer-tap knob) as it is ground on abrasive belt at extreme right. Square piece at upper right is an acrylic splash guard.

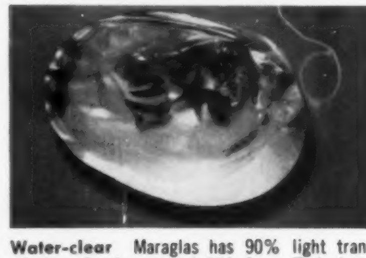
FIG. 4: A simple toggle-clamp holding an angle fixture is used to position beer-tap knob (right) for grinding knob shank at an angle against abrasive belt A, which is shown with its attendant back-up platen B.



Low-viscosity Maraglas liquid resin is readily blended with liquid hardener, by weight or by volume. Resin-hardener mixture has 10-hour pot life.



No vacuum or special equipment is necessary for easy production of durable, weather-resistant Maraglas castings in any size or shape.



Water-clear Maraglas has 90% light transmission. Castings are bubble-free. (Embedment by Miracle Plastic Mfg. Co., New York City).

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Plastic tooling time and labor costs are reduced by use in many industries of Marblette's epoxy casting and laminating resins.

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PLASTICS* TECHNICAL SECTION

MATERIALS · PROPERTIES · TESTING METHODS AND INSTRUMENTATION · STANDARDS · CHEMISTRY

Vinyl plasticizer developments

By Richard G. Kadesch[†]

The author: Dr. Kadesch was born in Annapolis, Md., in 1918, but attended the public schools of Cedar Falls, Iowa. He received the B.A. degree from Iowa State Teachers College, where he played varsity tennis, and his Ph.D in organic chemistry from the University of Chicago in 1941. With seventeen years of experience in industrial chemical research, he began as research chemist with the old Columbia Chemical Division of the Pittsburgh Plate Glass Co. During a period as Director of Research for the Plastics Division of the Reynolds Metals Co., he was selected as 'The Outstanding Young Man of the Year' in Gary, Indiana. Then came 10 years as Research Director for Emery Industries, Inc., Cincinnati, Ohio. In 1958 Dr. Kadesch set up private practice as a chemical consultant. Much of his experience has been with plastics and plasticizers.

The writer reviewed the field of plasticizers for vinyl chloride polymers and copolymers in 1952 (205). Trends that were noticeable at that time have developed further. Progress has been great and publications in the field numerous. This review covers developments in the rapidly moving vinyl plasticizer field since 1952. Several other reviews have appeared during this period (55, 287, 371, 372).

Commerical progress is illustrated by the Tariff Commission production figures shown in the table on p. 134. The major part of the plasticizer total is used with vinyls.

The generalized concepts held in 1952 of how a plasticizer operates have been repeatedly confirmed by later work. Many new physical measurements have been made illustrating the gross nature of polymer-plasticizer interaction.

Small amounts of plasticizer are firmly held by the resin. As plasticizer content increases a point is reached where additional plasticizer increments are loosely held. This usually gives rise to a break in the curve when some property is plotted against plasticizer content. Thus, migration and oil extraction of common plasticizers are comparable to nonmigrating plasticizers when their content is low and below the limit of "primary solvation" (433). Changes are considerable beyond this limit. That portion of the plasticizer which is relatively free is believed to be involved in migration or conduction of electric current (422). Equilibrium is believed to exist between plasticizer plus polymer and plasticizer-polymer solvate.

A similar transition from one state to another occurs when the temperature instead of plasticizer content is varied. With increasing temperature the change in refractive index (211) and dielectric constant (65) breaks sharply. Above this point the polymer-plasticizer system has predominately liquid character and below this point predominately solid character. The break point itself is considered a "freezing temperature" (211). Related to this is the recognition of two different mechanisms of plasticization (238).

In terms of more refined ideas of plasticizer action it has not been possible to confirm some earlier theories or arrive at any completely acceptable concept. The transition temperature for various mechanical and electrical properties of plasticized polyvinyl chloride (PVC) was shown to correlate with the volume fraction of compatible plasticizer present but the data are not explained by the relaxation theory (273).

Various mechanisms of plasticizer action have been reviewed including the effects of "internal plasticizer" (291). The use of an internal plasticizer involving long polymer side chains would appear to be the ultimate extension of

* Reg. U. S. Pat. Off.
† Chemical Consultant, 3232 Epworth Ave., Cincinnati 11, Ohio.

the concept that plasticizer action involves its strong long-term association with the polymer chain. Although internally plasticized vinyl chloride-vinyl stearate copolymer does show similarity to the conventional di-octyl phthalate or tricresyl phosphate system, there are definite differences in creep behavior (291).

From the dielectric loss of PVC plasticized with a series of phthalates it was concluded that the polymer-plasticizer interactions do not involve stochiometric association (245). Contrary to this, other dielectric loss studies are claimed to show that a plasticizer molecule is associated with a definite number of vinyl chloride units, depending on the nature of the plasticizer (180, 181). The effect of dibutyl phthalate on the viscoelastic properties of PVC and on the relaxation time has been studied (324). The relationship between tensile strength and brittle point is discussed for four different plasticizers and a theory proposed to explain the results (35).

Solvent power

Closely related to the mechanism of plasticizer action is the solvent power of the plasticizer or its ability to solvate the resin. This, of course, results from plasticizer-resin interaction which enables the plasticizer to function. Closely related properties are compatibility and efficiency which increases as solvent power increases. The solvating power of a plasticizer resides in one or more polar functional groups which it contains. This subject has been reviewed (394).

The water tolerance of an acetone solution of plasticizer is a measure of its solvent power. The relationship of water tolerance to compatibility (64), water extraction (64), and film clarity (268) has been discussed. Visual observation of the "clear point" of plastisols also indicates plasticizer solvent power (336). A related approach involves determination of plasticizing efficiency which is calculated as the decrease in "vitrification temperature" (relative to straight PVC) per mole percent of plasticizer. Various other properties seem to correlate with this plasticizing efficiency (233, 333). Other methods of determining efficiency involve measurement of viscosity of a dilute solution of PVC in plasticizer, amount of butanol to cause standard turbidity of a dilute solution of PVC in plasticizer, and equilibrium swelling of PVC film (129).

PVC and plasticizer production figures

	Production in millions of pounds		
	1949	*1953*	*1957*
Vinyl chloride polymers and copolymers	227	516	887
Plasticizers	166	293	442

The relative effectiveness of various functional groups in promoting plasticizer solvent power has been discussed by several workers (64, 203, 302). Among the most potent groups are ester and carbonyl. Also effective and frequently used are chlorine, ether, and aromatic ring. Generally, two or more such groups are necessary. Among the di- and tri-esters, which dominate the plasticizer field, is the following decreasing order of solvent power: phosphates, sulfonates, phthalates, succinates, adipates, suberates, azelates, sebacates (203). Efficiency among such esters is inversely related to their viscosity (203) and to their freezing point (423).

Changes in plasticizer efficiency within a given series have been closely examined. Efficiency of normal versus branched alkyl phthalates is the same as measured by gelatination temperature (424). Maximum solvation in the phthalate series is at butyl according to some methods of determination (129, 309, 400), but other methods indicate hexyl and octyl (129). Among the sebacates and phosphates the maximum solvent power is at butyl (309). In the series of straight chain diesters from dinonyl oxalate to dimethyl 1,16-hexadecanedicarboxylate (carbon number constant but ester group position varied) maximum solvency is shown by di-amyl sebacate and dibutyl 1,10-decanedicarboxylate (129). These straight chain esters are less potent than the phthalates. Other workers have determined the efficiency of a variety of different plasticizers (16, 276).

In the specific case of combining polyvinylidene chloride latex with plasticizer emulsion (2-ethylhexyl adipate or xenyl diphenyl phosphate), observation by centrifuging or by electron microscope shows that the plasticizer gradually penetrates the resin particles during four days (113). Triethylene glycol dicaprylate and triethylene glycol di-(2-ethylbutyrate) penetrate much more rapidly. Di-octyl phthalate penetrates much more slowly and butyl stearate still more slowly.

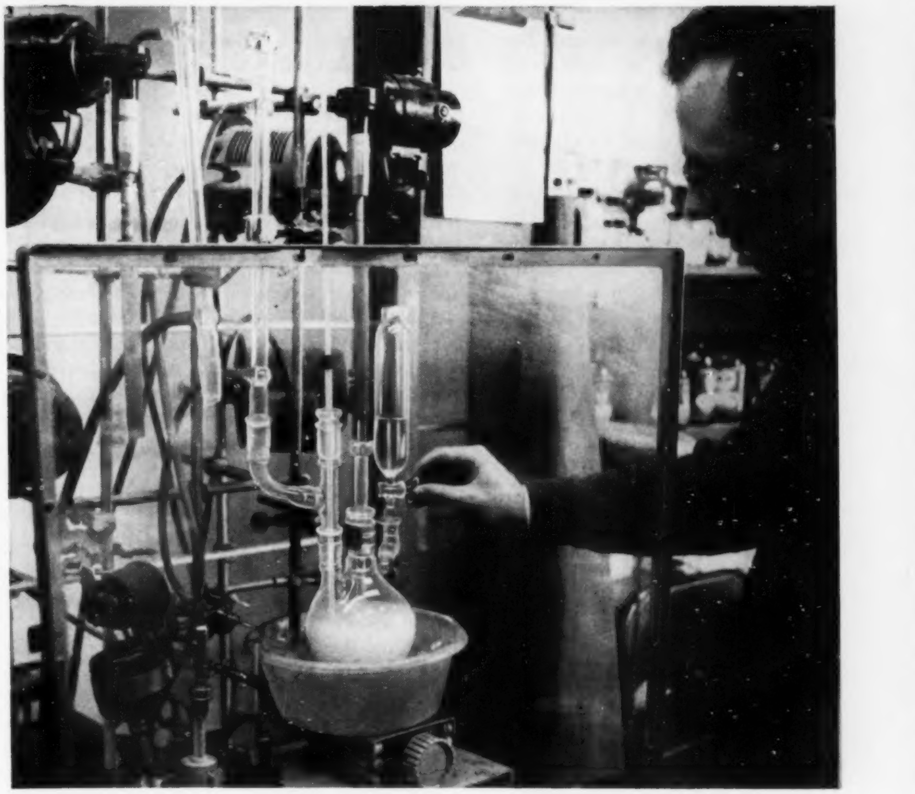
Formulating techniques

Plastisols: The availability of a wider variety of plasticizers has made it easier to devise blends with just the right balance to achieve the desired viscosity and viscosity stability of plastisols. The plastisol field generally has been reviewed by several authors (25, 149, 313, 385, 410, 414).

The nature of the PVC particles is an important factor in solvation. The molecular weight of the resin is of little importance but the area of contact between the PVC and plasticizer is the factor controlling solvation rate (322). The time and kind of mixing is unimportant (226).

Plastisol flow and viscosity properties, both fresh and after aging, have been studied for a large number of plasticizers (68, 141, 334, 386). Isodecyl phthalate, isodecyl adipate, and di-(2-ethylhexyl) azelate are the most resistant to viscosity increase. Intermediate in gelling tendency are such plasticizers as di-octyl adipate and di-octyl phthalate. Plasticizers that gel most easily on standing are tricresyl phosphate, dibutyl phthalate, butyl benzyl phthalate, and diethylene

Conducting an experimental epoxidation reaction at SOLVAY Technical Service, Syracuse, N. Y.



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glycol dibenzoate. For such highly solvating type plasticizers the concentration of plasticizer is more critical. The desired results can be obtained by blending. Thus, results similar to di-octyl phthalate are obtained by blending isodecyl phthalate with butyl benzyl phthalate (68). Of the phthalates, straight chain alcohols give lower plastisol viscosity than branched. Replacing the benzene ring by a cyclohexene or cyclohexane ring also reduces viscosity (334). The desired plastisol viscosity is related to the use (386).

A laboratory method is described for determining the fusion temperature of plastisols (267). The fusion temperature does not change as the result of prior aging and viscosity increase. Surprisingly, the fusion temperature increases as plasticizer content increases. The laboratory fusion temperature correlates with viscosity and can be used to determine actual processing requirements, not only for plastisols but for extrusion and calendering as well.

Plastigels are formed by the addition of various metal soaps to plastisols (282, 295). They have many uses in molding, casting, and extrusion. The gel structure holds its shape right up to fusion temperature, enabling accurate reproduction without molds or pressure. Di-octyl phthalate is commonly used. For larger amounts of plasticizer there is needed a larger amount of soap to prevent flow during fusion. The soap also acts as a heat stabilizer. Special formulations using aluminum stearate (332), barium ricinoleate (280), or aminated bentonite (335) have been patented.

Foaming plastisol formulations are capable of producing foam of density down to 12 lb./cu. ft. (11). Calcium sulfonate retards the solvation by plasticizer in foamed plastisols (386). Additives such as polyethylene glycol stearate (207) and polyethylene glycol ricinoleate (279) are effective for reducing plastisol viscosity.

Organosols: Extensive formulation data on organosols have been reported using several common plasticizers (292). Among the best plasticizers are di-octyl phthalate, dicapryl phthalate, and tri-octyl phosphate. Use of the optimum formulation is desirable because the viscosity-composition curves generally have a strong minimum. A technique of preparing organosols using a solvating plasticizer such as di-octyl phthalate and a weaker plasticizer such as tetraethylene glycol di-octanoate has been patented (201). Minimum viscosity is claimed for a combination of di-octyl phthalate and ethyl phthalyl ethyl glycolate dispersed in acetone (161).

Latices and hydrosols: Some aspects of plasticizing Saran latex are discussed above. The effect of di-octyl phthalate on film formation from PVC latex has been observed under microscope and electron microscope (151). The temperature of film formation decreases as di-octyl phthalate content increases. This is the opposite of the trend mentioned above for plastisol fusion. A technique for preparing an aqueous 80 to 95% jelly-like plasticizer dispersion and then combining it with an aqueous vinyl dispersion has been patented (221).

Dry blending: The suitability of a plasticizer for dry blending is shown by a paddle mixing test for measuring the plasticizer absorption rate of polyvinyl chloride (58). The mixing times to reach the end point fall in the order of plasticizer solvent power. This relationship has been confirmed (30). The plasticizer has more effect on dry blending behavior than the choice of resin. Thus, tricresyl phosphate dry blends readily but polymeric plasticizers dry blend slowly and require higher temperature.

Banbury mixing: The behavior of various plasticizers in compounding with PVC in a laboratory Banbury mixer has been examined (347).

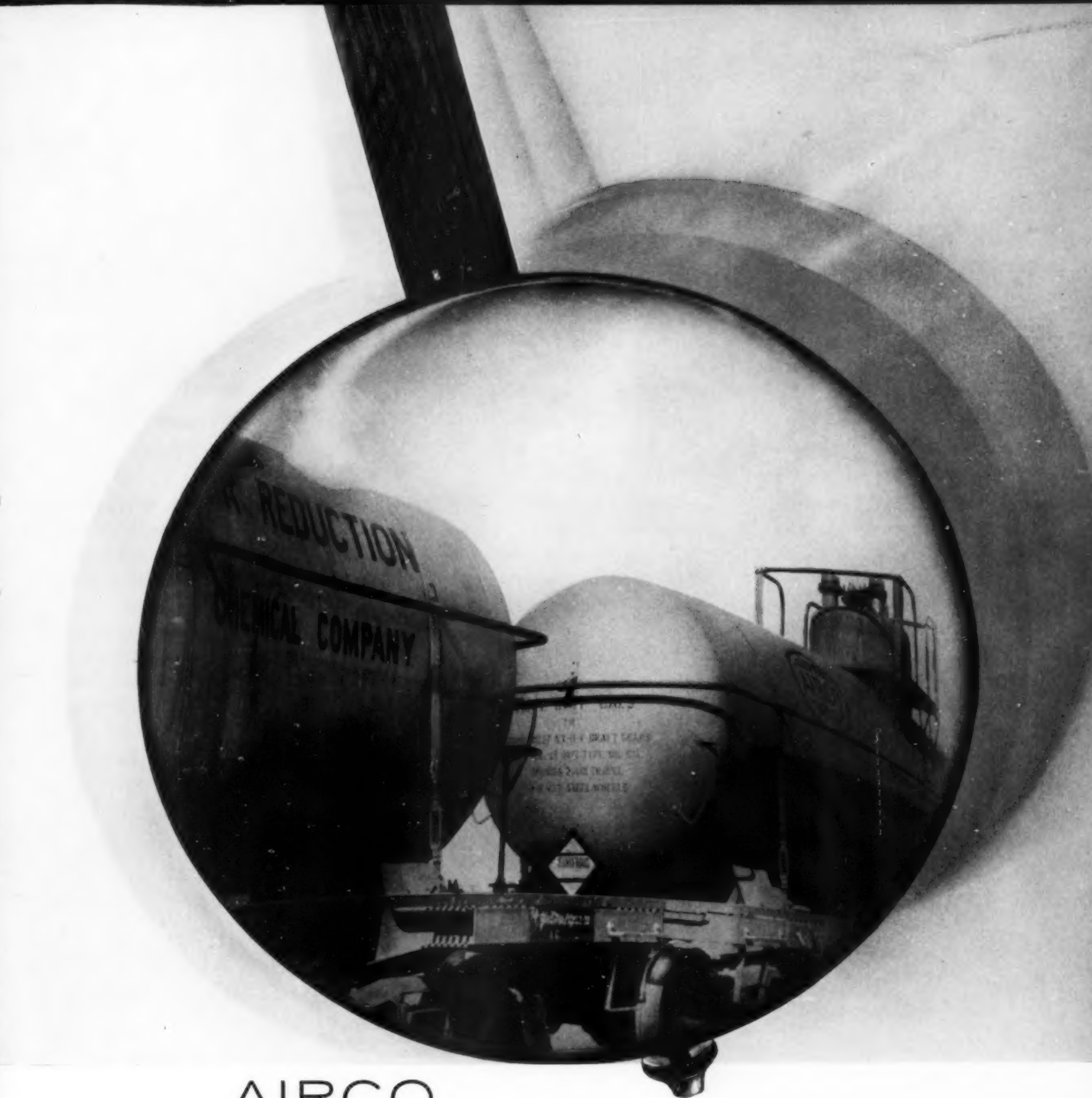
Pigments and colors: As a rule, any pigment or color can be used with any plasticizer. Pigments containing manganese, however, must be used with care because they promote the oxidative breakdown of certain plasticizers, particularly those containing ether oxygen (115, 421).

Properties

Several articles review the various test methods for evaluating vinyl film and sheeting (14, 278). Triangular coordinate graphs can be employed to represent three-component systems of resin and two plasticizers. The graphs enable the prediction of properties of a plasticizer blend from data on each plasticizer separately. Considerable data is given on systems containing di-octyl phthalate and tri-octyl phosphate to illustrate the method (401, 403).

Volatility: Although plasticizer volatility from the plasticized resin is the final criterion, if the vapor pressure of the plasticizer is greater than 10^{-6}mm. at 25° C., it is too volatile for practical use (294). Vola- **(To page 140)**

ALUMINUM CLAD WITH PLASTICIZED VINYL, produced by Clad Rex Corp., is used for roof, luggage racks, window frames, and wainscoting in this passenger bus.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tility of 44 plasticizers has been determined by three methods: 1) A.S.T.M. activated carbon absorption, 2) vapor pressure, and 3) milling (150). Tests 1 and 2 correlate fairly well, but 2 and 3 correlate better. Therefore, 1 is considered suitable only as a rough screening test. Room aging for as long as 2½ years does not bring out differences except for highly volatile plasticizers like dibutyl phthalate. Several other studies of plasticizer volatility have been made (275, 320). The extent of processing may be a factor (275).

Migration and sweat-out: Migration must occur before plasticizer can be removed by any means and therefore is a process involved in volatility, extraction, and rub-off. It is generally desirable to consider whether migration or plasticizer removal at the surface is the rate controlling factor in the results observed.

A correlation exists between migration and oil solubility (433). A study of plasticizer rub-off and loss in mineral oil or soapy water showed that the diffusion constants are about the same as in a vacuum. Therefore, migration was rate controlling in each case (294, 297). For simple water extraction migration was not rate controlling.

Weight loss after contact of a PVC composition with a dry, absorbent powder is a convenient means of measuring migration. The method shows polymeric plasticizers of the polyester type to be superior but some of them do migrate. Silica is generally used (59, 148, 160, 383). Activated carbon causes a much smaller loss, leading to the challenge that the method measures extraction by a solid rather than true plasticizer migration (383).

Migration of plasticizer from PVC into rubber (148) and lacquer surfaces (319) was studied. Against lacquer di-octyl phthalate is better than tricresyl phosphate and loss of butyl benzyl phthalate is almost zero. Dioctyl sebacate was found to exude more readily than any other plasticizer tested (404). Migration rate of a plasticizer depends on its chemical composition and mobility (29). Migration rate is related to the critical solution temperature of PVC in the plasticizer (381) and to the plasticizer's gelling property (29). At low plasticizer concentration the migration rate is very concentration dependent (210).

Extraction: Several thorough studies of plasticizer extraction have been made. The rate of loss in mineral oil or 5% soap solution or by rub-off (rotation of sample in a dry, inorganic powder) is proportional to the square root of time. In each case the extraction agrees closely, indicating that migration is rate controlling (294, 297). If the soap concentration is reduced or if a solvent is used which actively penetrates the sheet, then solubility factors enter in. The rate of water extraction is controlled by the rate of removal of plasticizer at the surface. This does not correlate with water solubility when flowing water is used (294). On the other hand, in static water extraction plasticizer solubility is considered to be controlling (329). Extraction of any kind becomes slower as time increases and the sheet becomes stiffer (244, 294). By using activated carbon in the water to absorb the plasticizer when it leaves the resin surface it is possible to prevent the saturation of water with plasticizer. This gives a rate of static water extraction about equal to that using a high water flow rate (329).

Extraction by various solvents has been studied (209, 259); the most resistant of the monomeric plasticizers to solvent extraction is tricresyl phosphate (209). Changes in weight of plasticized samples after immersion in mineral oil or organic solvents are not significant because of absorption of oil or solvent by the sample (259).

Heat and light stability: The numerous available epoxy esters are discussed below as plasticizers; as stabilizers of PVC toward heat and light they are very effective by functioning as hydrogen chloride acceptors. Surprisingly, *n*-hexyl epoxystearate was found to be very poor as a hydrogen chloride acceptor compared to epoxidized soya oil (402). Heat degradation of PVC, as measured by hydrogen chloride evolution, is more rapid when di-octyl phthalate is present relative to PVC alone. Differences also exist depending on the manner of incorporating the di-octyl phthalate (114). Epoxy stabilizers are particularly effective with chlorinated or phosphate plasticizers. Tin derivatives are good stabilizers for phosphates (246). Staycin 1 stabilizer is claimed to inhibit the spew on exposure of oil-type plasticizers such as ricinoleates and acetoxystearates (13). Dibutyl phthalate gives better stability than di-octyl phthalate when used with metal stearate stabilizers (395).

Electrical properties: The electrical properties of plasticizers and of plasticized PVC have been studied (167, 168, 396). Treatment of plasticizers with alumina improves electrical resistance (256). The dielectric constant of plasticized PVC increases with increasing temperature (65). There is a connection between water absorption and electrical resistance of plasticized PVC insulation (237). To determine the suitability against Underwriters' requirements, full scale testing is normally needed; such results can now be predicted by specially devised small scale laboratory tests (21, 27). Higher and higher temperature limits are being reached for electrical service by vinyl wire insulation. Polyesters and higher phthalates give the best results (7).

Toxicity: The number of suitable PVC plasticizers government-approved for use in food packaging increased from four in 1952 to 11 in 1956 (231). These consist of four phthalates, two citrates, two epoxies, one phosphate, one sebacate, and one adipate. There are differences among phthalates due to the alcohol portion of the ester (337). Thus, the octyl phthalates are approved only for foods of high water content and dibutyl phthalate is toxic. Phosphates also vary since tricresyl phosphate is toxic but 2-ethylhexyl diphenyl phosphate is non-toxic (388) and approved.

Plasticizer toxicity has been extensively studied and reviewed (30, 190, 229, 230, 232, 251, 351, 416). About a dozen other plasti-

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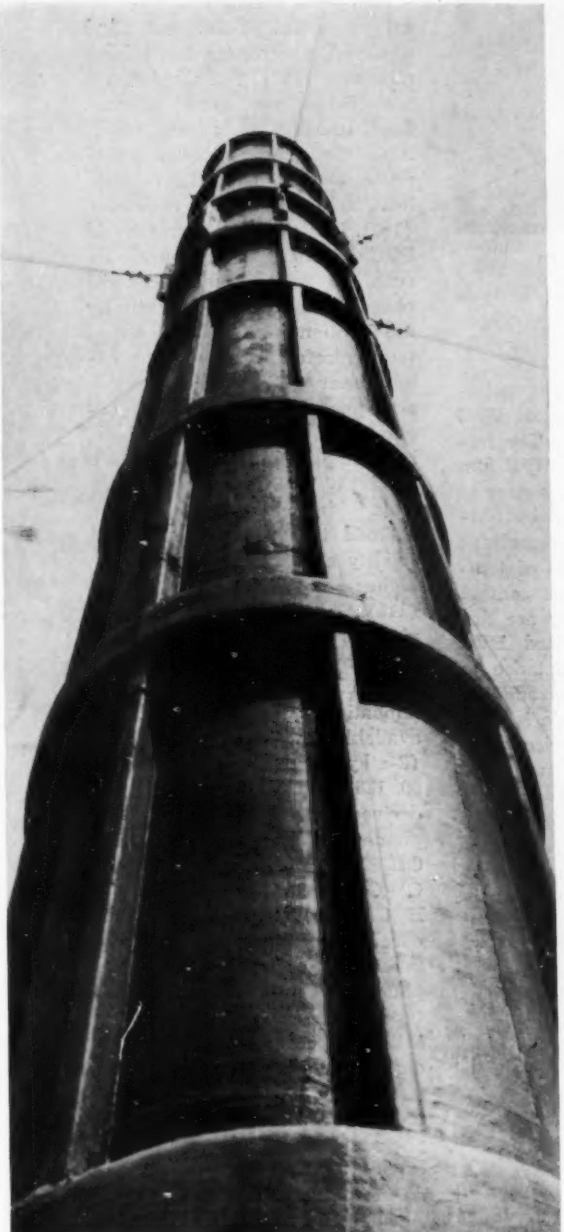

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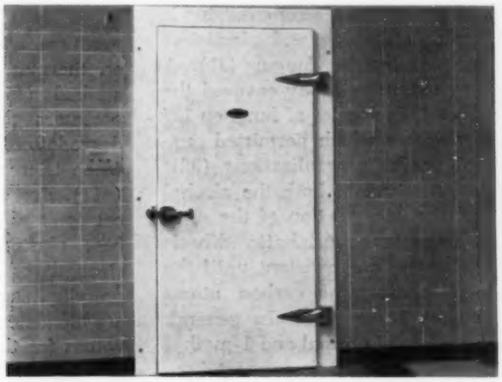

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cizers are considered by some to be non-toxic, although approval for food use has not been obtained. After more work some of these will undoubtedly obtain approval. Several of the non-toxic vinyl plasticizers have been classified as to their resistance to extraction (190).

Skin tests on 25 plasticizers showed that only five of them are neither irritating nor sensitizing (251). These are di-octyl adipate, di-octyl sebacate, dibutyl sebacate, butoxyethyl phthalate, and diglycol bis(butoxyethyl carbonate).

Fungus resistance: Considerable progress has been made toward correlating plasticizer structure with mold and fungus resistance. This is strictly a property of the plasticizer since PVC alone is not attacked (366). PVC containing di-octyl phthalate or Buna N is inert to the fungus Trichoderma. If dibutyl phthalate is added, there is attack and increase in tensile strength. This is due to stiffening and plasticizer removal by the fungus (31). A very extensive study covered the effect of 24 species of fungi on 127 plasticizers which permitted several useful generalizations (32): the structure of both the alcohol and the acid portion of the ester is important. Aliphatic dibasic acid esters are resistant until the total number of carbon atoms reaches 12 or more. In general, the esters of normal and 1-methyl substituted alcohols support fungus growth more readily than esters of other (branched) alcohols. The ether linkage decreases growth. In general, phosphates and phthalates (also see reference 34) do not support growth. The ability of fungi to utilize esters and fatty materials is widespread among the various species. The use of sulfonamides such as N-ethyl-p-toluenesulfonamide enables the incorporation of copper 8-quinolinolate into PVC without blooming (134).

Miscellaneous properties: A study of the Bashore resilience of PVC containing di-octyl phthalate indicated that as the temperature is raised the resilience goes through a maximum at 80 to 110° C., depending on plasticizer concentration (330). The effect of various plasticizers on the moisture vapor transmission of PVC film is reported (234). The hydrogen permeability of PVC film changes little in the glass stage as temperature is raised, but increases rapidly in the viscoelastic stage (362). The effects of temperature and plasticizer content on thermal conductivity are described (159). Plasticized PVC possesses the best resistance to degradation by gamma radiation when tricresyl phosphate is used (411). For outdoor service polyesters and Buna N are the best plasticizers (109). Tensile strength of PVC containing tricresyl phosphate-dibutyl phthalate blends can be calculated from values for the individual plasticizers (133). A thorough study of many properties of over 60 plasticizers in PVC revealed the importance of the viscosity of the plasticizer alone (16). As plasticizer viscosity increases, the tensile strength increases and low temperature flexibility suffers. Other properties also can be predicted from the plasticizer viscosity.

VINYL dolls, made from B. F. Goodrich material, are one of many toy applications.

Plasticizer types

Phosphate esters: Tricresyl phosphate continues as the work horse among the phosphates in spite of its toxicity and poor low temperature properties. This is by virtue of its excellent permanence, low volatility, and flame resistance. Based on a study of 45 phosphate esters, the relation between structure and flammability is discussed (266). The *o*-, *m*- and *p*-isomers of tricresyl phosphate were evaluated and the temperature dependence of various physical properties was determined (431).

Numerous chemical and physical properties of different alkyl diphenyl phosphates have been tabulated (157). The alkyl diaryl phosphates are more efficient than tricresyl phosphate (346). Also the propyl dixylyl phosphates are claimed to have better heat, light, and solvent resistance (196). The poor light stability of PVC containing an aryl phosphate such as 2-ethylhexyl diphenyl phosphate is improved greatly by the addition of a lesser amount of tetrahydrofurfuryl oleate as co-plasticizer (63). Di-alkyl monoaryl phosphates, such as di-(2-ethylhexyl) phenyl phosphate, have improved low temperature flexibility (156). Aryl phosphates from polychlorophenols are claimed to give PVC improved rigidity and flame resistance and higher heat distortion point (116). Chlorinated tricresyl phosphate is described (398).

The availability of new C_8-C_{13} oxo alcohols expands the list of aliphatic phosphates potentially available beyond the original tri-(2-ethylhexyl) phosphate (23, 50, 126, 355). Various fatty-acid-derived phosphates and phosphonates, such as $C_{11}H_{23}COOCH_2$-$CH_2PO(OC_4H_9)_2$, $C_{17}H_{33}COOCH_2$-$CH_2CH_2OPO(OC_2H_5)_2$, and C_{10}-$H_{21}CH(COOC_2H_5)PO(OC_4H_9)_2$, are excellent plasticizers at low temperature (375). The α-dialkylphosphono group of the latter type is extremely effective in achieving compatibility since it enables use of an unsubstituted straight chain of at least 16 carbon atoms. The addition of dibutyl phosphite to dibutyl maleate gives dibutyl 2-(dibutylphosphono) succinate, suitable for PVC (202). A flame-resistant plasticizer results from the reaction of a trialkyl phosphite together with a low molecular weight polymer or copolymer of allyl chloride (24).

Phthalate esters: As the volume of phthalate esters used in PVC has grown during recent years the relative importance of the octyl phthalates has dropped only

slightly and now is about half the total.

The availability of new alcohols has broadened considerably the number of available and potentially available di-alkyl phthalates (126, 355). Specific phthalates are derived from C_7-C_9 alcohols (26, 195), isodecanol (356), 2,4,4-trimethylpentanol (390), 3,5,5-trimethylhexanol (23, 50, 265), 2-propyl-4-methylpentanol (117), normal C_8, C_{10}, and C_{12} alcohols (265), cyclohexanol (257), methylcyclohexanol (257), 2-(2-ethoxyethyl) ethanol (265), α-methylbenzyl alcohol (112), and nopinenylmethanol (145). Didecyl phthalate has become popular. It offers fair low temperature properties (12), very good electrical properties (10), and low volatility. Using oxo alcohols, the best octyl phthalate results from octanol of a definite isomeric composition (261). However, it is somewhat inferior to iso-octyl terephthalate with respect to low temperature performance, heat and light stability, and loss on oven aging (357).

The gelling properties of 18 different phthalates for PVC were studied (303). Chlorine derivatives such as dimethyl tetrachlorophthalate (111) and the alkyl benzyl tetrachlorophthalates (158) have been patented.

Mixed phthalates are readily made because of the two-step reaction involved in converting phthalic anhydride to an ester. This is particularly useful when one of the alcohols is less reactive, such as capryl alcohol, and this is reacted first (41, 283). Numerous other mixed alkyl phthalates have been prepared (87, 91, 204, 265, 274, 387, 425). A small amount of butyl benzyl phthalate blended with di-octyl phthalate is claimed to reduce extraction by kerosene and other oily materials to an amazing degree (62). The mixed phthalate esters of a glycol and a monohydric alcohol are also useful in PVC (274, 408).

The quality of phthalate esters can be improved in various ways. Hydrogenation (51, 255), molecular distillation (227), or vacuum distillation with steam injection (1) are helpful. The tendency of oxo-alkyl phthalates to break down on aging is prevented by the addition of bisphenol-A as an anti-oxidant (137). The color of iso-octyl phthalate is improved by the addition of a little maleic anhydride prior to esterification (316).

Mono-esters: For a mono-ester to be compatible with PVC, and also high enough in molecular weight to be sufficiently nonvolatile, it is necessary to introduce some other compatibilizing functional group.

A cyclic group such as an aromatic nucleus is useful to supplement the ester group. The simplest of such systems are esters of phenols with fatty acids (183), phenols with benzoic acid (289), alcohols with benzoic acid (428), alcohols with phenylacetic acid (428), benzyl alcohol with fatty acids (428), alcohols with phenylstearic acid (406), and naphthylcarbinol with fatty acids (199).

Use of the ether group is illustrated by the mono-alkyl ethers of alkyl 9,10-dihydroxystearates (373).

Use of both ether and cyclic groups in a mono-ester is common. Both phenoxyethyl oleate and tetrahydrofurfuryl oleate are offered commercially as low temperature secondary plasticizers. The latter is stated to be the best of the two (263). Other tetrahydrofurfuryl esters are reported (382, 391, 425). Esters of phenylphenoxyacetic acid (78), C_6H_5O-$(CH_2CH_2O)_xH$ (46), and phenoxystearic acid (406) have been patented. Both thioether and cyclic groups are involved in $C_6H_5COOCH_2CH_2SCH_2CH_2C_6H_5$ (163).

The keto group is utilized in higher β-acyl acrylates (49). Keto and aromatic groups together are useful in the β-aroyl propionates (262).

Chlorine imparts compatibility to methyl pentachlorostearate. Its instability to heat and light is corrected by the addition of an epoxidized oil (317). The use of chlorine and aromatic groups together is involved in esters of chlorinated benzoic acids with phenol or chlorophenol (304) and in esters of γ-chlorophenylbutyric acid (191).

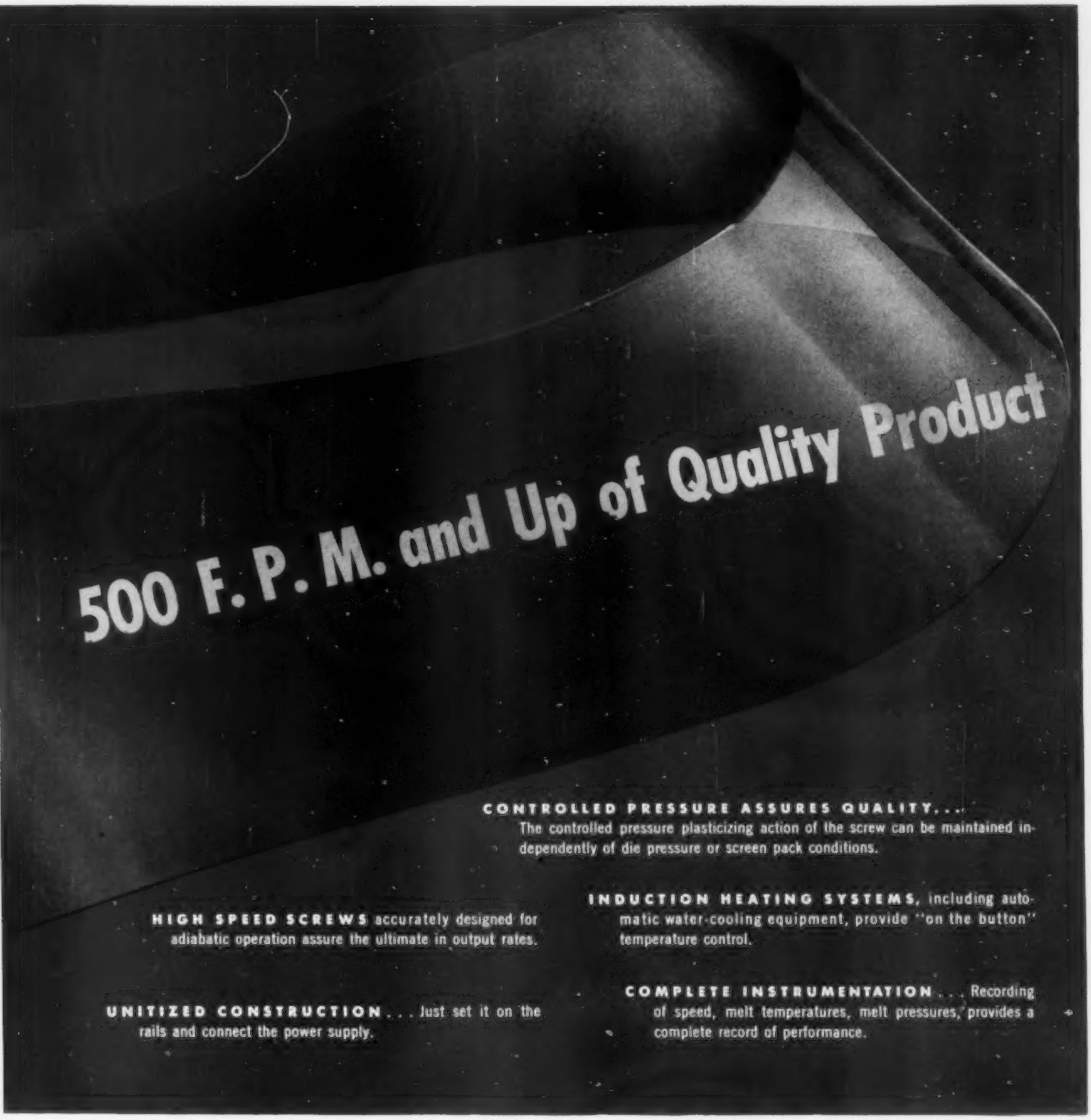
Hydroxyacid esters: Various ricinoleates have been in use for a long time. Some new types suggested are acetylated glyceryl mono-ricinoleate (175), methoxyethyl acetylricinoleate (264), and the condensation product of 2-(2-acetoxyethoxy) ethyl acetylricinoleate (incompatible by itself) and diethyl fumarate (104). Ricinoleates derived from acyl groups above acetyl or alcohols above methyl are not too suitable (264). Similar to the ricinoleates are the esters of hydroxystearic acid (281, 406) and 9, 10-dihydroxystearic acid (40, 45).

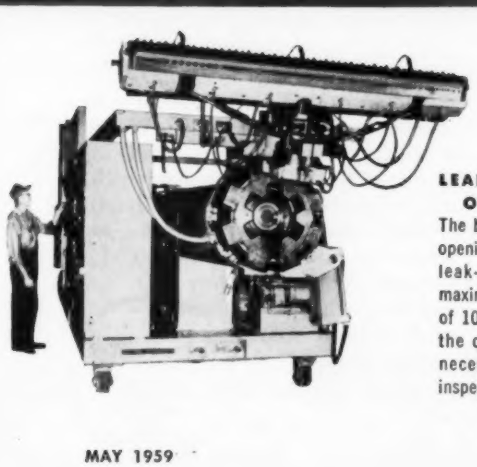
Esters of alkyl lactates with monobasic (131, 132) and dibasic acids (299, 300) have been suggested for use with PVC. Several complex lactates are also described (135, 298).

Citrates are of interest for food use. Toxicity data and physical properties for four different citrates are given (293).

Polyol esters: Glycol esters are popular because they impart good low temperature properties at low cost. To obtain compatibility it is necessary to have sufficient separation of the two ester groups which usually involves diethylene glycol, triethylene glycol, or dipropylene glycol. Such glycol esters may be derived from benzoic acid (197, 240, 260), *m*-toluic acid (118), levulinic acid (169), chloroacetic acid (240, 426), or C_5-C_{10} aliphatic acids (39, 182, 197, 264, 426). Blends of diethylene glycol dibenzoate and dipropylene glycol dibenzoate show lower volatility in PVC than does either plasticizer alone (260). Excellent low temperature flexibility is achieved by diethylene glycol esters of mixed oleic-benzoic acids (123) or caprylic-benzoic acids (122). Unique esters of ether glycols are the biscarbonates of chlorobutanol (389), sorbide esters (178, 185), levulinates of $HO(CH_2)_nOCH_2CH_2OH$ ($n = 4,5,6$) (121), esters of 2,4-dimethyl-2-methoxymethyl 1,5-pentanediol (352, 353), and thiodiglycol ester of C_7-C_9 acids (382).

It is often desirable to avoid ether oxygen in the glycol to get better water resistance and stability. Available ethylene and propylene glycol are **(To page 146)**





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not suitable because the resulting ester groups are too close together. Some improvement results from esters of butanediol (191, 264), 1,5-pentanediol (189), 1,6-hexanediol (191), and 3-methyl-1,5-pentanediol (124, 125). Even with the latter glycol at least 25 mole percent of the acid should be aromatic to get good compatibility (124). Compatibility of completely aliphatic esters is satisfactory even when higher glycols are used such as 1,12-octadecanediol (224) and 1,12-octadecenediol (223). An aromatic glycol such as $(CH_3)_2C_6H_2(CH_2OH)_2$ can be used (198, 427).

Among the triols, glycerol is suggested for plasticizer use when esterified with γ-chlorophenylbutyric acid (191) or with a mixture of short chain and long chain fatty acids (248, 263). Esters of C_2-C_8 aliphatic fatty acids with the triols 1,2,6-hexanetriol (413), 1,2,6-trihydroxysuberonitrile (367), 1,9,10-octadecanetriol (40), and 2,4,6-trihydroxymethyl phenyl allyl ether (253) have been patented.

Higher polyols are useful. Pentaerythritol dibutyrate dicaprylate is useful in electrical insulation at high temperature and humidity (170). Pentaerythritol tetra-(γ-chlorophenylbutyrate) is described (191). Sucrose octapropionate is compatible with Vinylite VYDR (the higher esters are not) but is relatively inefficient (432).

Di-esters: The term "di-ester" in the plasticizer field usually means an alkyl ester of a straight chain dibasic acid of the type $HOOC(CH_2)_nCOOH$ where $n =$ 4 to 8. Such esters impart good permanence and low temperature properties.

The adipates are described of 6-chlorohexanol-1 (328, 397), C_4-C_{10} oxo alcohols (12, 26), octanol-2 (265), benzyl alcohol (265), and tetrahydrofurfuryl alcohol (382). Various physical properties are described for 18 different dialkyl sebacate plasticizers (365). Mixed alkyl benzyl sebacates are suitable at −70° F. and are claimed to be superior to dibenzyl sebacate and the corresponding dialkyl sebacate (60). Adipates, azelates, and sebacates are described derived from 3,5,5-trimethylhexanol (50) (the azelate is a good plasticizer but cannot be used alone (265), α-methylbenzyl alcohol (112), 2-ethylhexanol (257, 265), cyclohexanol (257), oxo-decanol (126, 356), oxo-octanol (126, 355), oxo-tridecanol (126), and butanol (182). Isosebacate esters are useful (6, 42, 257). However, di-esters from simple dibasic acids outside the C_6-C_{10} range are less common.

Examples are the 2-ethylhexyl ester of mixed C_{11} and C_{12} dibasic acids (368), 4-nonylphenyl 2-ethylhexyl succinate (95), α-methylbenzyl succinate (112), and 6-chlorohexyl glutarate (328).

VARIETY of vinyl-coated glass pressure packages. Coating prevents glass from shattering if bottle breaks. Containers are produced by Owens-Illinois Glass Co.

Esters of dibasic acids containing other functional groups have value, such as the esters of diglycolic acid (50, 126, 327, 355, 356, 382), maleic acid (50, 265, 328, 355), fumaric acid (50), 4-ketopimelic acid (155), itaconic acid (217), thiodipropionic acid (355), butyryl-succinic acid (277), thiodiglycolic acid (382), $CH_3CH(SCH_2COOH)_2$ (192), and certain sulfonyl dicarboxylic acids (33, 54, 120).

Esters derived from various cyclic dibasic acids have been evaluated as vinyl plasticizers. These include esters of α-phenylglutaric acid (242), benzylsuccinic acid (254), pinic acid (61, 138, 241), diphenic acid (83, 369), phenyl trimethylindanedicarboxylic acid (286), $HOOCCH_2OC_6H_4$-$C_6H_4OCH_2COOH$ (79), β-propiolactone-eleostearic acid adduct (193), and dicarboxylic acids derived from tetrahydrofuran (184, 348).

Tri-esters and higher esters: The aconitates and tricarballylates are excellent plasticizers for both Vinylite (247, 315, 355) and Saran (182, 305). Esters of thiodisuccinic acid (271) and 1,2,4-butanetricarboxylic acid (37) are patented.

There is considerable literature on tri-esters of maleic anhydride adducts with unsaturated fatty acids. Although there seems to be no commercial product of this type, such esters appear to have considerable merit. The trimethyl ester is generally preferred and may be derived from oleic acid (338, 339, 340, 341, 343, 345, 429), erucic acid (338, 340, 343), rice bran fatty acids (341), alkali-conjugated soya fatty acids (67), or tall oil (48). Some of these esters are claimed to be equivalent to or better than di-octyl phthalate. Their quality can be improved by hydrogenation with little change in their mechanical properties in PVC (339, 341, 345, 429). Higher alkyl esters have been derived from maleic anhydride and oleic acid (70, 72, 342, 344) or undecenoic acid (73). Such oleic or undecenoic acid adducts have been esterified with benzyl alcohol (76), tetrahydrofurfuryl alcohol (99, 106), cyclohexanol (71), and various alkoxyethanols (74, 75). By condensing maleic anhydride with an alkyl oleate (71) or aryl undecenoate (81) and then esterifying with a different alcohol, mixed ester plasticizers are obtained.

Highly functional polybasic acid esters are obtained by condensing 1 to 4 moles of a dialkyl fumarate with an unsaturated ester. The latter may be soya oil (98), oleate ester (53, 89, 107), dilinoleate ester (82, 85), or dibutyl di-isobutenyl succinate (101, 105). Variations of this approach are the condensates of tri-ethyl aconitate and ethyl oleate (77), di-ethyl fumarate and ethyl benzoylacetate (88), di-ethyl maleate and ethyl benzoylacetate (94), tri-ethyl aconitate and di-ethyl fumarate (92), and di-ethyl succinate and di-ethyl fumarate (93).

Epoxy esters: These are classed separately because of the strong

modifying character of the epoxide group in increasing compatibility and stabilizing PVC compositions toward heat and light. The epoxy esters have made tremendous gains in obtaining commercial acceptance during the last few years. Epoxy plasticizers, when used in vinyl foams, promote the decomposition of the blowing agent more than other plasticizers (152).

Epoxy mono-esters have good low temperature properties, are not outstanding for nonvolatility, and are generally inferior to di-octyl phthalate on extraction. The hexyl and octyl epoxystearates are probably the most commonly used. Tridecyl epoxystearate is incompatible (417). Butyl epoxystearate from butyl oleate (cis) is superior to that from butyl elaidate (trans) on low temperature flexibility, exudation during aging, and on gasoline and mineral oil extraction (47). Numerous workers have evaluated epoxidized alkyl oleates and related fatty acid esters (47, 171, 188, 272, 312, 379, 380). Epoxidized oleates of ether alcohols are described (364). The epoxy group can be placed in the alkyl portion of the mono-ester by epoxidizing oleyl acetate or oleyl oleate (47, 397). Cyclic epoxy esters are derived from cyclohexenyl carbinol (44, 392).

Epoxy di-ester plasticizers are derived from dicrotyl adipate (284), di-oleyl adipate (314), dimethyl dilinoleate (379), or dimethyl-8,12-eicosadiene-1,20-dioate (258). Epoxy glycol esters are derived from types such as diethylene glycol di-oleate (379) and propylene glycol di-oleate (188, 272, 380). The latter epoxy ester is similar to di-octyl phthalate in performance and intermediate in low temperature flexibility between iso-octyl epoxystearate and epoxy soya oil. The epoxyhexahydrophthalates have excellent properties (44, 172, 392), the isodecyl ester being particularly recommended. Various ricinoleates have been epoxidized (97, 103, 219).

Epoxidized esters of higher polyols, particularly glycerol, are extremely useful. The first commercially important epoxy ester plasticizer was epoxidized soya oil

SIDE PANEL in this Pullman car is vinyl plastisol-coated steel. Eye appeal and durability are major advantages.

(272, 379) which has low volatility and soapy water extraction. A disadvantage is exudation during light exposure which has been improved by hydrogenation to lower residual unsaturation (321). Other epoxidized glycerides are derived from rice oil (173), menhaden oil (173), safflower oil (173), acetylated castor oil (219), and diacetomonoglycerides (22, 173, 374, 417). The latter compares favorably with di-octyl phthalate. Of a wide variety of epoxy esters, the most resistant to marring of cellulose nitrate are epoxy soya oil and epoxy tall oil fatty acid esters of pentaerythritol (188).

Polymeric plasticizers: The low molecular weight (commonly in the 2000 range) polyesters have been the most popular type of polymeric plasticizer for PVC. Molecular weight is commonly controlled by chain termination with a monofunctional alcohol or fatty acid but this device need not necessarily be used. The popularity of polyesters is due to their outstanding permanence, especially resistance to migration and extraction (209), combined with fair low temperature properties. These advantages have been reviewed (208).

In polyesters the individual segments control the viscosity-temperature relationship but the molecular size controls the migration. Polyesters do not behave as effectively as their component units because some of the polyester groups are prevented from associating with the polymer (203). Primary hexanediol and octanediol are best for use in polyester plasticizers. Propylene glycol is actually the most commonly used glycol because of its branching. Otherwise, as with 1,4-butanediol, the melting point is too high (4). A good compromise between fluidity and low temperature flexibility is achieved by using a blend of propylene glycol and 1,4-butanediol (415). Special properties result from certain glycols such as compatibility from diethylene glycol (288) and light color from neopentyl glycol (9, 225). For the dibasic acid component adipic acid is popular (4, 9, 174, 206, 252, 288, 359). Very good properties result by using azelaic acid (4, 225, 359, 363) or sebacic acid (36, 225). Also used are succinic, glutaric, and thiodipropionic acids (225). It is claimed that better compatibility results from using mixed acids and/or mixed glycols rather than a single acid and a single glycol (243). Maleic anhydride is not suitable (4). Phthalic anhydride is ordinarily not suitable because of poor flexibility but this can be offset by using high molecular weight polyols such as 9,10-dihydroxystearic acid (212) or 2,4-dimethyl -2-(2-hydroxyethoxymethyl)-pentanediol-1,5 (136). Unsaturated polyesters containing oleic acid can be epoxidized before use (3). The heat and/or light stability of polyesters is improved by adding barium ricinoleate (354) or by treating with calcium oxide (359) or sodium hydroxide (358). Better heat stability also results by preparing the polyester by alcoholysis from dimethyl adipate (358, 359).

The butadiene-acrylonitrile copolymer rubbers known as Buna N and Hycar are readily processed into PVC and impart excellent solvent resistance and low temperature properties (142, 177, 269, 307). Several studies have been made of such compositions (5, 187, 399, 412). As the acrylonitrile content of the Buna N increases, compatibility increases and moisture permeability decreases (235), low temperature impact strength decreases and oil resistance increases (177). Tensile strength is maximum at 37% acrylonitrile content in the Buna N (308). Tear resistance and flame resistance are good (142). Such polymer blends can be con-

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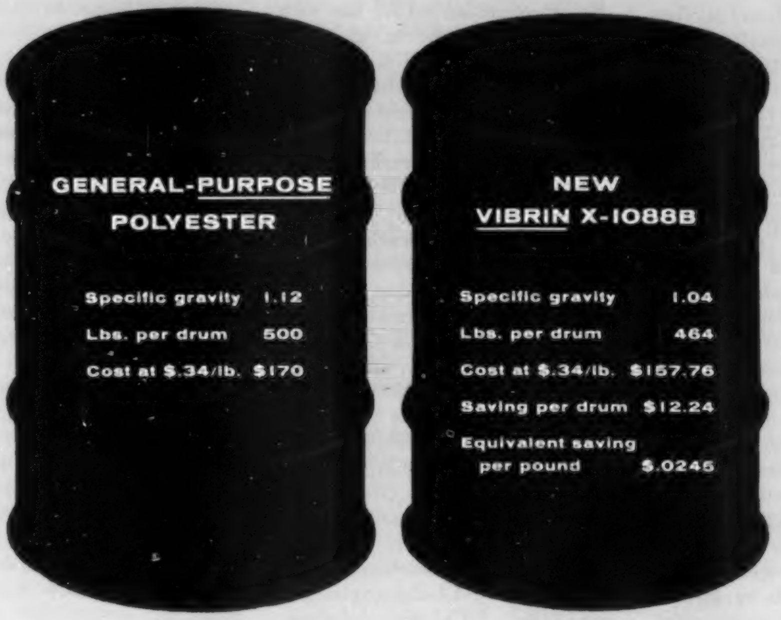

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verted to foams (239, 290) and plastisols (166). For plastisol work a liquid butadiene-acrylonitrile copolymer is used. Closely related polymer blends with PVC contain Buna N and Neoprene (349), butadiene-acrylonitrile-isobutylene copolymer (28), or butadiene-methyl isopropenyl ketone copolymer (326).

Many other polymers prepared by addition polymerization can be used as plasticizers for PVC. Examples are the low molecular weight liquid polymers of ethyl acrylate (236, 301), butyl acrylate (301), alkyl methacrylates (66, 200), and α-methylstyrene (153); also copolymers from vinyl acetate and ethylene (110), styrene and methyl methacrylate (393), styrene and butadiene (139), or allyl propionate and octene-1 (38). Higher molecular weight polymers increase the impact strength of PVC (a solubilizing plasticizer decreases impact strength); since rigidity is maintained, these blends are more resin alloys than plasticized compositions. Polymers used are Neoprene (377) and copolymers of methyl acrylate and butadiene (378), di-ethyl fumarate and butadiene (360), or ethylene and vinylene carbonate (325).

PVC compositions of normal hardness can be prepared from highly fluid plastisols by formulating with a reactive unsaturated plasticizer and then polymerizing it with peroxide. Frequently a regular plasticizer is also used. Suitable polymerizable plasticizers are polyethylene glycol dimethacrylates (8, 52), vinylcyclohexyl maleate or fumarate (228), dibutyl methacrylyloxy-chloropropyl phosphate (179), and diethylene glycol maleate (323). Another approach combines a polyepoxide, such as a liquid glycidyl polyether of bisphenol, with PVC and di-octyl phthalate (434) or tricresyl phosphate (270). Curing is by an amine or a boron trifluoride complex.

Sulfonate esters: One of the German Mesamoll plasticizers was $RSO_3C_6H_5$ (*R* derived from kerosene by sulfochlorination to give the intermediate RSO_2Cl). Such products have since been described in the United States in which the alkyl portion is derived from C_{19}-C_{21} paraffins (165), C_{16} branched paraffins (215), octane (102), or C_{10}-C_{14} α-olefins (164). Techniques of improving the quality of aryl alkanesulfonates are reported (213, 214).

Hydrocarbons: Polynuclear aromatic hydrocarbons are used as low cost secondary plasticizer extenders and impart excellent electrical properties. They also provide good fungus and chemical resistance. A partially hydrogenated alkylaryl hydrocarbon (HB-20) is recommended for use with di-octyl phthalate in plastisols (15). Also suggested are coal tar pitch (108), hydrocarbons of 200 to 800 molecular weight extracted from mineral oil distillates (130), and aromatic hydrocarbons boiling at 580 to 760° F. (Sovaloid C) (331).

Chlorinated hydrocarbons: The use of various halogen-containing plasticizers in PVC has been reviewed (384). Chlorinated cyclic hydrocarbons are low cost plasticizers which improve flame and fungus resistance. Examples are benzene hexachloride (57), 1-chloronaphthalene (69), dichlorodiphenylmethane (405), chloroalkyl chlorobenzene (162), pentachloro-*t*-butylbenzene (409), dichlorodiphenylethane (144), bis (chloronaphthyl)-methane (143), and 2-chloro-1,1-diphenylethylene (146). 1-Chloronaphthalene is a good plasticizer for polyvinylidene chloride but hexachlorobenzene is poor (154).

Nitriles: Although the cyano group is a fairly effective solubilizing group, no recent examples were found where it is used alone. The ether group is often present also because of the availability of β-cyanoethers. Such plasticizers of the type $ROCH_2CH_2CN$ may involve *R* as derived from hexadecanol (218), methyl ricinoleate (218), 2-(2-phenethylthio)ethanol (80, 86), and phenyl methyl carbinol (127). Supplementing the cyano group by the aromatic ring is involved in phenylstearonitrile (407). An added epoxide group is used in 9,10-epoxystearonitrile (312).

Amides: Several carboxylic acid amides of the type $RCONR_1R_2$ have been evaluated in PVC (249, 250). *R* may be derived from stearic, oleic, linoleic, or cottonseed acid. The R_1R_2N-group may be derived from the secondary amines–morpholine, N-methylaniline, diphenylamine, dibenzylamine, or dicyclohexylamine. Best results are from morpholine and an unsaturated fatty acid. Oleic morpholide has excellent physical properties and mills well, but heat stability is poor.

Forty-one different sulfonamides were evaluated, their heat stabilities ranging from fair to poor (2). Alkylaryl sulfonamides of the type $RSO_2N(C_2H_5)_2$ (186) and the morpholide of dodecanesulfonic acid (90) have been patented.

Nitrogen-containing esters: Because nitrogen-containing groups contribute heavily to solvating power, esters containing such groups are classed separately. Such compounds are ester amides, ester nitriles, and ester amines.

The simplest type of ester amide is made from an alkanolamine and the equivalent moles of fatty acid. For satisfactory compatibility a secondary amine is used. Of many such types evaluated, the C_8-C_{10} fatty acid derivatives of diethanolamine are best (19, 350). Other ester amide types are 9,10-carbonato-N,N-dimethylstearamide (311) and lactam derivatives (176, 216, 217).

The ester nitriles are illustrated by β-cyanoethyl oleate (296), 9,10-carbonatostearonitrile (310), and phenyl ester substituted stearonitrile (406). However, more complex (To page 222)

AFTER one year of service, this 24-in. Koroseal plasticized polyvinyl chloride conveyor belt shows virtually no signs of wear.

Sorbitol polyethers in rigid urethane foam

By Joseph E. Wilson*

Prior to 1958, commercial rigid urethane foams were prepared by reacting a suitable hydroxyl-terminated polyester with tolylene diisocyanate (TDI), water, and catalyst. Foaming took place, and the resulting foam was cured under the proper conditions. Polyesters have been employed from time to time in such rigid foam preparations because of their multiple functionality and cross-linking potential.

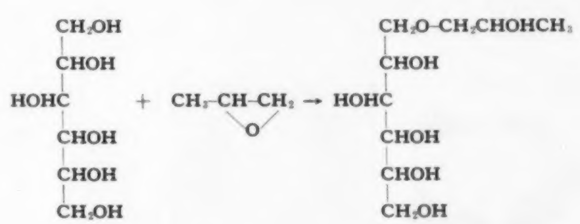
The multiple functionality may be obtained by the incorporation of glycerol in the polyester, with a branch of side chain arising at each glycerol molecule in the backbone of the polyester chain. In this way, by regulating the glycerol content, it is possible to obtain polyesters of high, moderate, and low degree of branching. Generally speaking, polyesters used in rigid foams are highly branched, while those in flexible foams are unbranched.

Commercial flexible foams have been based on both polyesters and polyethers. Polyether-based foams have been taking over a progressively larger share of the flexible foam market. There are several reasons for the rapid expansion of the use of polyethers in the flexible foam field. Since polyethers cost less than polyesters, polyether-based flexible foams have the advantage of lower cost. Polyether foams have generally better resilience than polyester foams. Polyether foams show much better resistance to hydrolytic agents than polyester foams (1).[1] For example, retention of tensile strength and dimensional stability was excellent for polyether foams after seven days immersion in 10% aqueous sulfuric acid or 10% aqueous sodium hydroxide, but poor for polyester foams under the same conditions.

One of the newsworthy events of 1958 was the entry of the polyethers as major components of rigid urethane foams. That development resulted partly from the demonstration in this laboratory that certain highly functional hydroxyl-terminated polyethers can be used as major components (50 to 60 weight percent) of rigid urethane foams.

Preparation of polyethers

Hexafunctional polyethers are prepared by reacting propylene oxide with sorbitol. The addition of the first molecule of propylene oxide with sorbitol can be visualized as follows:



The reaction is carried out at elevated temperature and pressure in the presence of a suitable catalyst. More and more molecules of propylene oxide can be added until there are long chains of propylene oxide extending from the sites of the original hydroxyl groups of the sorbitol molecule. The initial attack is most heavy on the primary hydroxyls, but after all hydroxyls become secondary the probability of attack at each hydroxyl is perhaps roughly equal to the probability at any other hydroxyl. The final product can be described as a hexa-functional molecule bearing six secondary hydroxyl groups of approximately equal reactivity toward isocyanate. Such products have been prepared using propylene oxide-to-sorbitol mole ratios of 10/1, 20/1, 40/1, and 80/1; they are pale yellow, free flowing liquids that are soluble in a variety of solvents.

The computed molecular weights and approximate hydroxyl numbers for these materials are shown in Table I, p. 154. Because of the statistical nature of the propylene oxide chain length, there is actually a molecular weight distribution for each material. The smaller molecular weight compounds have the higher hydroxyl numbers and will consequently produce higher concentrations of cross-links in the resulting urethane polymer formed by reaction with tolylene diisocyanate. On the other hand, the polyoxypropylene(80) sorbitol produces a much smaller number of cross-links per unit of mass, and hence might well find use at a suitable concentration in semi-rigid and flexible foams, as well as in rigid foams.

Care was taken in the preparation of these materials to meet the purity requirements of urethane foam ingredients. Some of the critical properties of urethane raw materials are water content, ash content, and pH. Water content is critical, since any water present will consume tolylene diisocyanate. Pilot plant quantities of the polyoxypropy- **(To page 154)**

*Atlas Technical Center, Atlas Powder Co., Wilmington, Del.
[1]Numbers in parentheses link to references at end of article, p. 154.

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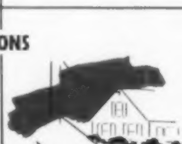

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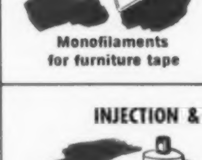

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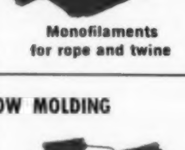

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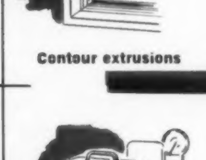

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Table I: Properties of sorbitol polyethers

Compound	Molecular weight	Brookfield viscosity, 25° C.	Hydroxyl number[a]
		cp.	
Polyoxypropylene (10) sorbitol	760	7550	433
Polyoxypropylene (20) sorbitol	1340	1070	260
Polyoxypropylene (40) sorbitol	2500	440	146
Polyoxypropylene (80) sorbitol	4830	480	93

[a] Defined as milligrams of potassium hydroxide equivalent to the hydroxyl groups present in one gram of compound.

lene sorbitols are now being prepared that contain 0.1% water or less, and plant scale quantities can be produced with no change in technique. Ash content is important, because it is an indication of the amount of inorganic impurities. Such inorganic impurities, if present at too high a concentration, could cause premature gelation in the preparation of the prepolymer or in the foam formulation. The ash content of the polyoxypropylene sorbitols is 0.01% or less, a level that has been found quite satisfactory in prepolymers and in foam preparation. The pH is also an important property, since any material having a mildly alkaline or strongly acidic pH will tend to gel prematurely when mixed with TDI. The pH of the polyoxypropylene sorbitols falls in the correct range of 5.5 to 6.0. The viscosity of these materials ranges from 400 to 7600 cp. This low viscosity makes for convenient handling and pumping of these materials in foaming machines. Polyesters employed in rigid foams are generally quite high in viscosity, values of 50,000 centipoises or more being quite common.

Preparation of foams

The principles of rigid foam formulation with the new polyethers can be illustrated by a few formulations based on polyoxypropylene(10) sorbitol. In the preparation of a typical foam, a prepolymer was first prepared from the following ingredients: Polyoxypropylene(10) sorbitol, 219.9 g.; TDI (80/20), 564.5 g.; and benzoyl chloride, 0.56 grams.

These reactants were stirred for ½ hr. under dry nitrogen at 70° C. The prepolymer was allowed to cool to room temperature. The following ingredients were then mixed thoroughly: Prepolymer, 50 g.; polyoxypropylene(10) sorbitol, 38.6 g.; and DC 200 (50), which is a Dow Corning Corp. silicone, 22 grams.

The following components were then added to the mixture and stirred in thoroughly: Water, 0.25 g. and N-methyl morpholine, 0.3 grams.

The mixture was poured into a cardboard container and allowed to foam completely (10 min.) at room temperature. The foam was then cured overnight in an oven at 70° C. (Alternatively, a cure of 1 to 2 hr. at 100° C. could be employed.) The resulting foam was white and had uniform cell size. Its density was 7.5 lb./cu. ft. It has compressive strength values of 188, 189, and 250 p.s.i. at 10, 25, and 50% compression, respectively. These compressive strength values are roughly in the center of the range of published values for commercial polyester-based rigid urethane foams.

Similar procedure was used to prepare foams of lower density from polyoxypropylene(10) sorbitol. For example, a prepolymer was first prepared from the following materials: Polyoxypropylene(10) sorbitol, 64.6 g.; TDI (80/20), 153.8 g.; and benzoyl chloride, 0.15 gram.

These materials were reacted for ½ hr. at 70° C. under a blanket of dry nitrogen. After the prepolymer had cooled to room temperature it was employed in formulating the following composition: Prepolymer, 20.0 g.; polyoxypropylene(10) sorbitol, 10.6 g.; DC 200 (50), 0.09 g.; water, 0.40 g.; N-methyl morpholine, 0.17 g.; and tri-ethylamine, 0.035 gram.

The other ingredients were added to the prepolymer and mixed in thoroughly. Foaming began almost immediately and was complete in approximately 5 minutes. After 10 min. the foam was transferred to an oven and held at 70° C. overnight for curing. The resulting fine-textured foam had a density of 1.7 lb./cu. ft. The compressive strength values were 21.2, 26.8, and 30.0 p.s.i. at 10, 25, and 50% compression, respectively. Again, these values are in the same range as those for commercial polyester-based rigid foams at the same density level.

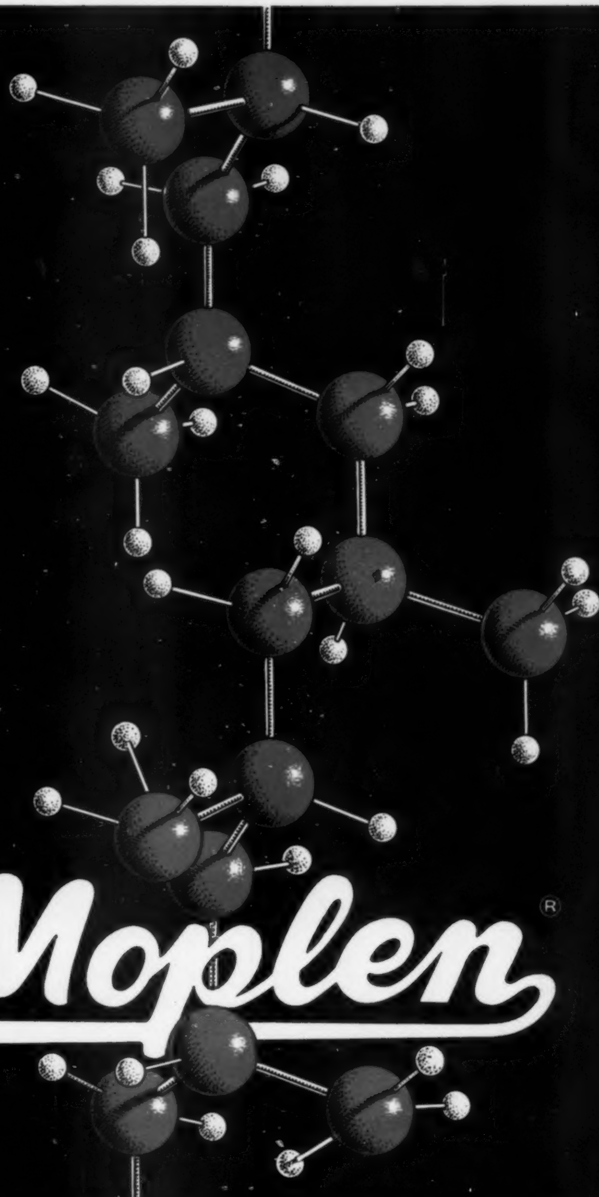
The unique property of the new sorbitol polyethers is their high functionality, which causes them to equal the polyesters in cross-linking efficiency. It may also be noted that foams based on polyoxypropylene sorbitols contain no ester linkages, and hence would be expected to be resistant to degradation under hydrolytic conditions. The high functionality of the polyoxypropylene sorbitols also makes them potentially valuable ingredients in polyurethane coatings and adhesives. One laboratory (2) has already observed that the incorporation of sorbitol itself in castor oil/tolylene diisocyanate coatings results in increased coating hardness, speed of cure, tensile strength, and solvent resistance.

This research is being extended at present to an investigation of propylene oxide derivatives of other hexitols in polyurethane foams and coatings.

References

1. "Polyether flexible foams," Technical Data Sheet No. 11058, National Aniline Div., Allied Chemical Corp.

2. "Polyol-modified castor oil—Nacconate 80 coatings," National Aniline Div., Allied Chemical Corp. (1958).—**End**



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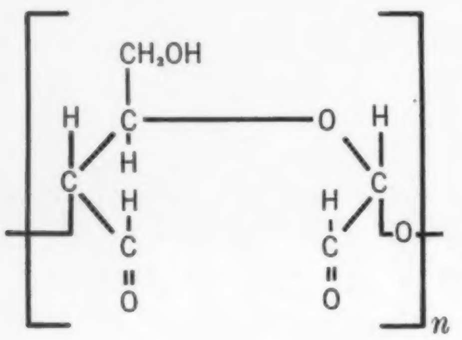
Dialdehyde Starch is described as "cornstarch oxidized by periodate ion. Oxidation breaks the carbon-to-carbon bond between C_2 and C_3 of the starch molecule's glucose units, forming a dialdehyde unit. Any number of glucose units can be oxidized, depending on the properties wanted at the time." (Chem. & Eng. News, Dec. 9, 1957)

Following is the structural formula and the list of tentative specifications for SUMSTAR now being made in limited quantities. (The specifications will vary, of course, for specific grades and types of SUMSTAR.)



description: Free-flowing white to pale yellow powder

percent aldehyde content: As required (corrected for water)

currently available: 1. Over 90%
2. 75%-80%
3. 50%

water: Less than 10%

heavy metals: 20 ppm. maximum

sulfated ash: 1% maximum

The applications of this polymeric dialdehyde for industry appear to be almost unlimited. Many uses have already been evaluated and many others are in the process of evaluation. Here are some of the principal industrial applications which are being evaluated:

leather—tanning
textiles—crease resistance and waterproofing
plastics—new polymers
paper—increase in wet strength

The many areas in which applications research on SUMSTAR is under way cover as broad a range as the chemical industry itself. Here is, for example, a polymer with the functional groups of glyoxal. Evaluation of SUMSTAR as a photographic hardener, bacterial inhibitor in cutting oils, vulcanization retardant, coating for printing plates, etc., are a few suggested areas for product development and process modification with SUMSTAR.

SUMSTAR[T.M.] is now available in limited quantities. Samples are available upon request.

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INTERNATIONAL PLASTICS EXHIBITION and CONVENTION

1959

The First International Plastics Exhibition and Convention, successor to four British Plastics Exhibitions and Conventions, will open its doors on June 17 in Olympia, London. For the next 10 days, over 270 manufacturers of materials, equipment, and products will show off their latest developments. The more than 250,000 sq. ft. of floor space will feature exhibits by 13 different countries, including the U. S.

The conference program will present 16 papers, two by U. S. speakers.

This biennial event has increased in significance over the years. European plastics developments—in machinery, materials, products, and design—have been rapid and at times revolutionary. Coupled with the establishment of the European Common Market, this year's show has assumed heightened importance.

To brief our readers on what new developments may be revealed at the Show, the editors of MODERN PLASTICS have asked authorities of the British plastics industry to preview the exhibition and outline what the visitor can expect to find. These advance reports appear on the following pages.

Invitations to our readers from the presidents of the two British plastics societies are printed below. The program of the conference, together with a list of exhibitors, begins on page 170.

Dr. J. C. Swallow, president of the Plastics Institute, was born in Devon in 1903 and educated at London and Leiden Universities. He joined the Research Department of Brunner Mond and Company, one of the four companies from which Imperial Chemical Industries, Ltd. (ICI) was formed, in 1924. From 1935-42 he was largely engaged in the development of the process for the manufacture of high pressure polythene and its uses. In 1942 he became Research Director of the Plastics Division of ICI, in 1951 Managing Director, and in 1952 Chairman of the Division, a position he still holds.

Come to the fair

On the occasion of the First International Plastics Exhibition to be held in London, I welcome the opportunity of addressing a few words to the many readers of MODERN PLASTICS.

Originally the British Plastics Industry was content to show its products at a section of the now defunct British Industries Fair, and as it grew it was decided to have its own Exhibition which has been held several times in the last few years. Now it has opened its doors and invited overseas companies to join it in a large International Plastics Exhibition.

The large body of technologists, scientists, and engineers who are members of the Plastics Institute welcome this opportunity of meeting and greeting their opposite numbers from all countries, and in particular will look

forward to seeing many friends from the U.S.A.

We in Britain are proud of our relatively young but powerful industry, and we give place to none in the diversity and quality of the goods we have to show. This country can justly be proud of its contributions, both scientific and technological in the field of high polymers, and the plastics industry itself is now vigorously exploiting all fields of plastics progress. Furthermore, the engineering side has not lagged behind, and has greatly assisted in the development of discoveries made by scientists in this country.

On behalf of the Plastics Institute, which includes many overseas members, we welcome all visitors to this Exhibition. We commend you to read the account of it in this issue of MODERN PLASTICS, and hope to see many of you during the time the Exhibition is open. Perhaps we may be fortunate in persuading you to join us in our work of extending the knowledge and appreciation of plastics throughout the world.

***Mr. Charles H. Glassey**, newly elected president of The British Plastics Federation, joined The British Cyanides Co. Ltd. in 1907 at the age of 16 as a Junior Works Chemist. At the age of 23 he was made Works Manager of the newly formed British Potash Co. Ltd. When The British Cyanides Co. Ltd. formed The Beetle Products Co. Ltd., Mr. Glassey became Sales Director. He was elected a member of the British Industrial Plastics Ltd. Board in 1937. In 1949 he became Managing Director of the B.I.P. Group of companies, a position he still holds, and is Chairman of all the subsidiary companies.*

He was elected the first Chairman of the Midlands Section of The Plastics Institute in 1932, and became Chairman of Council in 1934. He is now a Vice-President and an F.P.I.

He served on many of The British Plastics Federation Committees between the years 1943 to 1949.

I wish, on behalf of the Executives, the Council, and all members of The British Plastics Federation, to extend a hearty welcome to all those concerned with the Plastics Industry in the U.S.A. who propose to visit us during the forthcoming International Plastics Exhibition, which will be held June 17-27 in London.

We believe we can show them much of interest, and we look forward to reciprocating in some measure the hospitality that so many of us have received in your country.

***Mr. H. Senior** is the Managing Director of Cascelloid, Leicester, England, and a Director of its parent company, The British Xylonite Co. Ltd. A Yorkshireman, he attended Huddersfield College and later obtained London University Degrees in Science and Economics. He is also a Chartered Accountant.*

Mr. Senior has traveled extensively for his company in most parts of the world, and is a fairly regular visitor to the United States.

He takes part in the civic life of Leicester and sits on various committees, mainly connected with education. He is a member of the Court of Leicester University, a Governor of the Colleges of Art and Technology and a Past-President of the Leicester Chamber of Commerce.

New processes to be shown

Many fundamental changes are now being made in the methods and techniques of processing plastics and these will be reflected by the exhibits shown this year at the International Plastics Exhibition.

The principal trend is towards simplification to attain the maximum benefits from new machinery and new materials in the most economical way. Cost is the prime concern and constant attention is devoted to reducing unnecessary expense incurred by using outdated processes and equipment.

The two most recently introduced materials, polypropylene and polycarbonates, have required an extension of the techniques already employed rather than the development of new methods.

Injection Moulding. In Europe, interest in

the field of injection moulding is centering on the use of fully automatic machines, of small capacity, working at high speeds, and studies are being made of the performance and production rates of these small capacity machines for comparison with the results obtained when multi-impression moulds are used on large machines.

In machine construction there is a tendency to swing from piston to screw injection. This is the equivalent in the plastics field of the swing in engineering generally from piston or reciprocating movement to turbine engines. One of the main reasons for this change in the plastics field is the greater homogeneity that can be obtained when operating by screw injection. Certain materials, such as unplasticized polyvinyl chloride, necessitate this technique.

Swing to screw injection

The application of high-pressure injection, which was emphasized at the 1958 United States National Plastics Exposition, will be followed up by the English machine manufacturers, and there will be examples of the equipment necessary for sequential moulding. The achievement of these higher speeds of injection presents an immediate challenge to the basic design of the injection moulding machine, for it is illogical to inject in one second or a fraction of a second and then to take five to seven minutes to complete the full cycle. The indications are that the cooling cycle will become completely independent of the injection cycle. This trend is already apparent in the Foster Wurcher machine with its horizontal table, and further development of this principle will see moulds being carried from the injection point on a vertical plane using a rotating turntable.

How to speed up moulding cycle

Other equipment for speeding up the moulding cycle and facilitating production, such as preplasticizers, will also be shown. There has been increased interest in the whole theory and practice of preplasticizing during the two years since the last British Plastics Exhibition. These new developments all have as their purpose the desire to reduce material costs, which can be done by reducing packing in the mould, avoiding over-thickened walls, and excessive high pressure. Two-stage preplasticizing claims to have achieved this and the new machinery developments are on the lines of smaller and cheaper models.

The blow moulding technique continues to expand in Europe and will take its place eventually with the other injection methods. Considerable difficulty is occasioned by the development of machinery for blow moulding by manufacturers in countries which are free from patent restriction. This machinery, when delivered to a plastics manufacturer in another country, places the operator in a position where he may contravene the patents existing in his own country. Incidentally, it is noteworthy that several of the leading Continental machinery manufacturers will be exhibiting at Olympia.

Vacuum Forming. The machines shown for vacuum forming will illustrate the greatly improved techniques which have been developed in this field. Manufacturers are now considering these machines mainly as packaging units, that is, as machines which not only form the pack but also fill it and seal it, and this has had considerable influence on their design and construction.

A change is also apparent in the vacuum forming equipment for the manufacture of large sections, such as refrigerator components, where vacuum forming has almost completely replaced the old metal stamping method of manufacture. The vacuum forming machines for this section of the industry all make use of the drape-moulding technique and larger and more detailed shapes can now be successfully formed on these large capacity machines.

Extrusion. Here the equipment shown will emphasize the current preoccupation with the extrusion of sheet and film and also the greater interest in the production of filaments, particularly using the newer plastics such as linear polythene, polypropylene, and polycarbonates.

Much work is being devoted at present to developing plastics for use by the building industry, but no startlingly new practical applications can be expected to be shown at the exhibition since work is only in the development stage.

The printing of plastic sheet, film, and containers is receiving considerable attention, polythene and polyvinyl chloride being the two bases in greatest use. The new equipment shown will take one of two forms: either machinery for pre-treating the actual plastic to assist adhesion when printed by conventional methods, or new printing techniques obviating the necessity for pre-treatment.

Welding. Heat-sealing and high-frequency welding is a growing side of plastics fabrication. One tendency is for sealing machines to be considered as packaging units and for them to be fitted to trim, fill, and seal, rather than just to seal the film or sheet. Special equipment has been devised for sealing extruded plastics mesh. New solutions to the problem of separating the finished article

from the sealing tool after sealing has taken place will be demonstrated. For straight line seals impulse welding, using a thin metal tape as a heater medium, is the most favoured method. Roller welding, where heat is applied either directly through metal rollers or through a heated wedge with subsequent rolling, is used when the seal is to have a shape other than a straight line. The new methods will aim to give a firmer, cleaner weld without lessening the strength of the material, also to reduce the time taken between welding each article, for a faster operational sequence would lower costs.

Faster RP moulding

Reinforced Plastics. Interest in reinforced plastics centres on new methods and greater mechanization. There will be examples of reinforcement using new base materials, such as sisal. Stress will be laid on the greater clarity obtained for fibre-glass reinforced products by the use of various new resins and resin combinations, or different types of glass, glass fibres, mats, or rovings.

New ideas for speeding up the impregnation and drying out of reinforced plastic products will be closely examined. The major problem in the reinforced plastics industry still remains the high cost due to the amount of time and hand labour involved.

There will be various examples of new applications, for the full extent of the field open to reinforced plastics has still to be realized. Techniques are constantly being improved and the many excellent properties which are offered by the various laminate combinations ensure that continuous work will be devoted to their development.

Design. One of the features of this year's exhibition is the emphasis placed on good design. The importance of designing specifically for plastics, instead of merely adapting the traditional designs intended for realization in other materials, has at last been generally appreciated and has led to a new approach to the problem of design, with the many properties of plastics being fully exploited.

As additional encouragement, a prize is to be awarded this year for the product which is considered to be the best designed, and the leading articles will be listed by the design institute in the appropriate country of origin.

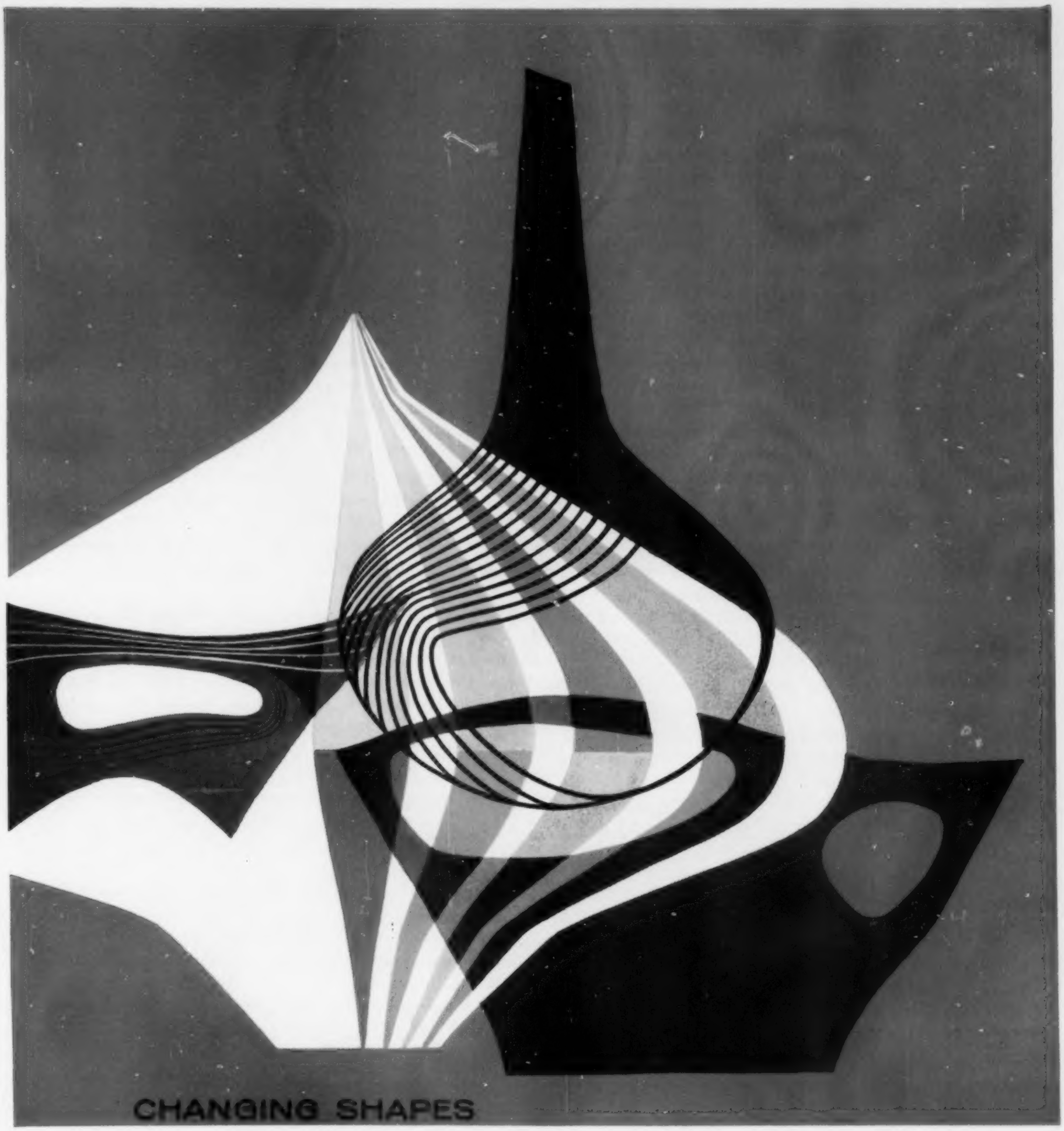
From the foregoing it is apparent that the 1959 exhibition will both stimulate and encourage the plastics manufacturer, spurring him on to develop new and better processing methods and production techniques.

Mr. R. E. Gregory Windsor *was born in London on May 14, 1923. He became an apprentice in his father's engineering company, learning technical machines and accessories. He served in the RAF from 1941-1946 and upon his release from service rejoined the technical machines and accessories division of R. H. Windsor Ltd. Upon the death of his father in 1947, Mr. Windsor took over control of the company and later, when formed into a limited company, was appointed its first Managing Director, a position which he still holds today. The company is now one of the largest manufacturers of plastics machinery. Mr. Windsor has flown over 750,000 miles all over the world, including over 60 Atlantic crossings. He has opened up new companies in Australia, Canada, and Germany. He is also Managing Director of Wedley and Scott Ltd., Klaxon Ltd., and subsidiary companies.*

New machinery on display

On the injection moulding side there is no doubt that at least five manufacturers will be showing even faster cycle automatic machines with special emphasis on the small capacity machines particularly aimed at the thin walled container and packaging field which is expanding rapidly in the U. K. and in Europe. But in contrast to the S.P.I. Show in Chicago last November, where nearly every manufacturer of machines exhibited a fast cycle automatic to feed the United States vast packaging field, it is not my opinion that the automatic, while badly needed, will highlight the Show.

Great strides have taken place in the design and production of pre-plasticizer machines over the last five years, particularly the twin and single screw type by British and German companies, to make possible even greater stress-free mouldings in faster cycle times than hitherto possible and to cater to the new materials in the polyethylene, polycarbonate, polypropylene, nylon, and rigid PVC fields. Visitors to the International Plastics Exhibition can, therefore, expect to see a great lineup of competitive models from the U. K. and Germany, in particular in the screw pre-plasticizers field, with machines


CHANGING SHAPES

ranging from 5- and 6-oz. single screw pre-plasticizer machines with quite a fast cycle for technical and standard mouldings up to and through the range and capacities to the latest 200-oz. built in Great Britain using the twin screw principle incorporated in a two-stage unit. This machine has a plasticizing capacity of 420 lb. of polystyrene per hour calculated on the continuous rating of the pre-plasticizer. This machine was briefly described in MODERN PLASTICS (November 1958), and although several are already operating in Germany on large refrigerator parts, the first ever in the U. K. was delivered a few weeks back.

Other methods of pre-plasticizing will no doubt be seen at the International Plastics Exhibition apart from standard machines, but the trend is quite definitely towards the screw-type machine.

High-capacity twin-screw extruders to be exhibited

Extrusion machines of the single screw type to be seen at the Show are expected to follow along the same trend as in the U.S.A., with emphasis for large extruders with bigger screw diameters and greater speed all round. Apart from the British-designed single-screw machines, extruders will be exhibited by Germany and France, showing this trend together with American designed machines produced in Great Britain. There will also be on show the twin-screw extrusion machines with various take-offs and an announcement of much higher capacity twin-screw extruders, not only for extrusion but for compounding and mixing of raw materials.

It is impossible to deal at any length with the **extrusion blow moulding** machines in this short preview for the International Plastics Exhibition 1959. Many types of blow moulding machines are coming to our knowledge from all over the world, and there is no doubt that considerable interest is being shown in this type of equipment as was evidenced at the S.P.I. Show in Chicago. Which company, either British or foreign, will show such a machine at the I.P.E. is not known at the date of going to press, but readers can be assured that one of the companies producing this type of machinery will be exhibiting blow moulding equipment.

In respect of the **compression moulding** field many moulders over the years have been asking themselves: Is compression moulding on its way out? Will thermoplastics take over and to what degree? It is my opinion that compression moulding machines still have quite a large part to play in the plastics field and in discussion with various compression machine manufacturers there is no doubt that the trend appears to be for larger fully automatic machines, but with an emphasis on more individual requirements. In other words, the standard compression machine, as known to us, would appear to be falling away, but is being replaced by special purpose field units. One such company in Great Britain has reported that 80% of its present day production is now in respect of this type of machine.

A well-known British company which has specialized for some years in metal deposition moulds of various types will be exhibiting its latest techniques of this type of mould making, which has not previously been carried out by the method of metal deposition. They are also making their entry into the moulding machinery field by exhibiting a completely new **slush moulding** machine. It will indeed be interesting to see the new types of moulds and the design and production possibilities of their new moulding machines.

On the equipment side a very well-known American company will be demonstrating its latest range of **temperature control instruments** whereby they state they can hold temperatures to an exact degree due to the fact that their design does not allow a direct on- and off-current and the current is only reduced when necessary, thereby preventing override. This will be the first time at a plastics show that this company has exhibited with its latest equipment, and many machinery houses are looking forward with some interest to seeing this equipment in operation.

Various take-off equipments for tube and pipe up to 10 in. diameter will be exhibited in operation by both British and foreign companies and a complete range of granulating/kibbling machines for the reclamation of scrap mouldings will be shown by another British company with capacities up to 400 lb./hr. Further, at least two British companies will be exhibiting their latest range of vacuum-metalizing machines. There will also be seen a range of machines for the printing and marking of plastics, and included in this range will be several machines for printing on cables, tube, and sheeting, a large platen machine for the refrigerator and radio field and one for printing on cylindrical mouldings.

Lastly, in the field of **vacuum and drape forming**, there is expected to be seen the latest developments by British and European manufacturers. I understand from European manufacturers of this type of machinery that they have to get down to much deeper drawers than previously, and to do this they have

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Exterior of the Research Laboratories

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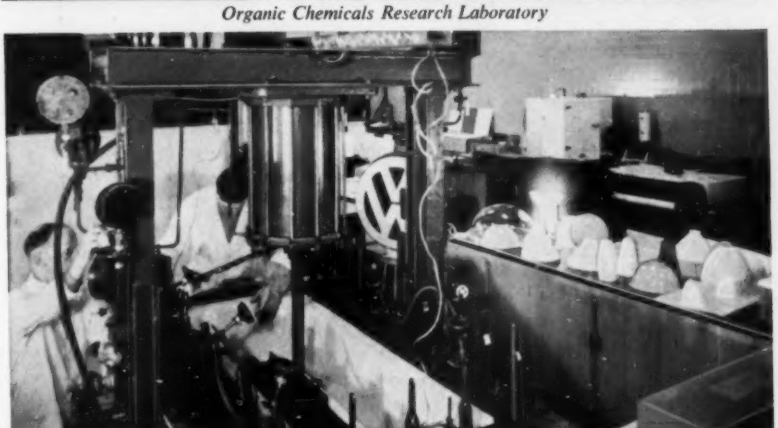

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17-27 June 1959
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devised a composite machine—to be exhibited at the International Plastics Exhibition—which is basically a drape machine with a pneumatic or hydraulically assisted core. They have been successful in this forming with polycarbonate and polypropylene.

This year's International Plastics Exhibition in London should be the best we have had yet and there is no doubt that a very great interest is being shown in it and many visitors from all over the world will be attending to see the latest machinery and equipment being offered to the world's Plastics Industry.

Dr. J. E. Sisson joined Imperial Chemical Industries Limited from Bristol University in 1933. His first appointment was as Technical Officer at Billingham, where he was engaged on plastics research. In 1936 he became Works Manager of the "Mouldrite" factory at Croydon, making phenolic powders and resins. In 1943 Dr. Sisson was appointed Manager of Home Sales Control Department at Welwyn and four years later he went to the Southern Regional Sales organization as Manager of the Plastics Department. He returned to Welwyn as Division Sales Director in 1949. On September 27, 1951, Dr. Sisson was appointed Joint Managing Director of Plastics Division and this position he still holds.

He has held office on the Executive and the Council of the British Plastics Federation, and is a Fellow of the Plastics Institute.

New materials to be seen

Notable developments in raw materials will be seen mainly — though not exclusively — among the thermoplastics. In acrylics there is particular interest in the newly-introduced fine powder form for moulding and extrusion. This type of material is readily dry coloured by the processor and this fact together with the lower cost of the polymer compared with the coloured and compounded acrylics moulding materials has quickened interest in the moulding and extrusion of acrylics. The new style of telephone adopted by the British Post Office will be moulded in this material, and there are important developments in the use of extruded acrylics by the lighting industry.

Among acrylic sheet materials the major point of interest is the ever widening colour range and the growth of interest in profiled and patterned sheet.

The number of manufacturers showing polythene is greater than ever before and materials of all densities from 0.91 to 0.96 are being offered. Materials of low and intermediate density continue to be preferred by British moulders and extruders, except for special applications, though much blending is done, particularly by moulders of housewares.

Two manufacturers will probably show polypropylene.

There is considerable interest in polyamides. In addition to Types 66 and 610 nylons and copolymers and blends of these manufactured in Great Britain, examples of Type 6 and Type 11 nylons from sources on the continent of Europe will also be shown. The recently developed high viscosity 66 nylon is expected to create particular interest for extrusion and for bottle production. The development of nylon bottles is being watched for the packaging of aerosols. There is also interest in extruded nylon film and tube.

The new high impact PVC materials will be featured and it seems likely that they will bring Britain into line with other European countries as a major user of PVC for water pipe, guttering, and rainwater goods. New vinyl copolymers have been developed too, and there is much interest in the application of these from solution for paper and card coating. A newly introduced copolymer sheet designed particularly for vacuum forming will be shown and may herald the re-entry of vinyl sheet into markets at present held by toughened polystyrene sheeting.

PVC foams will also attract attention. The tussle between these, rubber latex foams, and polyurethane foams, has yet to be sorted out, Visitors will have the opportunity to compare British PVC foams with British urethane foams of polyether and polyester types.

With PTFE, probably the most interesting single feature is the recently announced price reduction. This, coupled with the availability of the full range of types of PTFE — granular polymers, pre-sintered granular polymer, coagulated dispersion polymer, dispersions, primers, and finishes, should ensure considerable interest in this important material.

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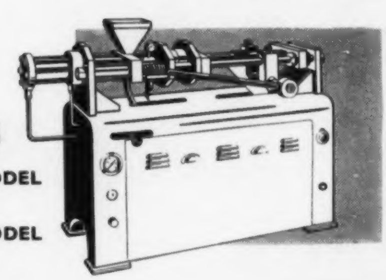

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171

international plastics exhibition

be on display, and in particular the toughened materials and the polystyrene foams will be spotlighted.

ABS materials now made in Britain under license from the U.S.A. will be on show, and, as they are relatively new to the British plastics industry, will no doubt attract considerable attention.

Among the most interesting of the development materials to be seen in the show are those in butadiene copolymers, particularly the novel butadiene/methyl methacrylate copolymers and the nitrile rubbers. Butadiene-methyl methacrylate copolymers, first considered as pigment binders for paints, are in fact proving particularly successful as pigment binders in paper coating and leather finishing.

PVC-rubber blends

A recent British development is the use of PVC-nitrile rubber blends, which are ozone-resistant, tough, oil-resistant, and vulcanizable and it is used for cable sheathing, hose covering, and lining, and the moulding and extrusion of mechanicals. A suitable blend is available for those fabricators unable to do their own compounding.

Finally, among the thermoplastics, mention must be made of polyethylene terephthalate film. Although this has been available for some time in Britain, it is only recently that it has gone into full-scale production, but use in the electrical industry, in packaging, and in textiles is growing fast. Some novel decorative applications are also noteworthy.

Among the thermosetting materials, first mention must be given to alkyd moulding materials which, slow to start in Britain, have recently been stirring up considerable interest. Mineral-filled granular and putty grades are used and more recently alkyds reinforced with glass, asbestos, and other fibrous fillers have been introduced, for use in miniature electrical components and in armaments and missiles.

Developments with epoxy and polyester resins will be seen — particularly the use of the latter in boat and vehicle construction.

Among the older thermosetting materials there are new developments with urea bonded block board faced with melamine-surfaced laminates. There is growing interest in low-priced urea foams for specialized packaging, in new phenolic blends and phenolic moulding powders with improved fillers, and also to be seen will be more and better examples of decorated melamine mouldings and an appreciably wider range of uses for wood-filled ureas.

While the major developments are to be seen in the field of thermoplastics, the thermosetting sector will be by no means devoid of new interest. All in all, for the man interested in raw materials, the exhibition will have a lot to offer.

Program of the conference

Monday, June 22

Polyolefins

"Mechanical and physical properties of polypropylene," by J. M. Goppel, Shell Laboratories, Amsterdam, Holland.

"The moulding characteristics of polypropylene," by G. Campbell, Plastics Div., Imperial Chemical Industries Ltd., Welwyn Garden City, England.

Material developments

"Some new amine hardened epoxide resin systems and their properties," by R. N. Lewis, Bakelite Ltd., Birmingham, England.

"Some theoretical and experimental aspects of block and graft copolymers syntheses," by J. Benton and C. M. Thomas, British Geon Ltd., Barry, South Wales.

Tuesday, June 23

Design trends

In the United Kingdom, by Robin Day.

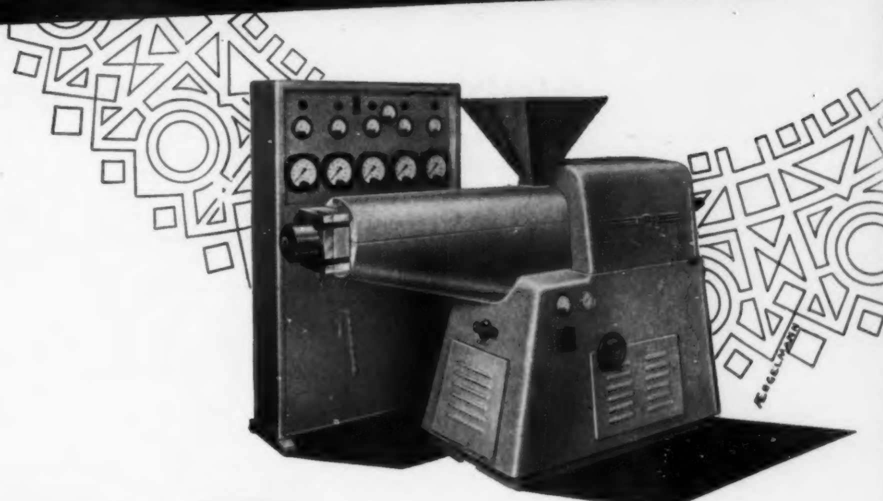
In Scandinavia, by Count Sigvard Bernadotte.

In Italy, by Ernesto Rogers.

Recent developments in glass reinforced plastics

In Benelux countries, by Roelf Tunteler, Plastics Research Institute, T.N.O., Delft, Holland.

In United Kingdom, by Brian Parkyn, Scott

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In the United States, by Harrison C. Blankmeyer, Owens-Corning Fiberglas Corp., Ashton, R. I., U.S.A.

Wednesday, June 24

Expanded plastics

"Recent developments in foamed plastics in the U.S.A.," by Miss Betty Lou Raskin, The Johns Hopkins University, Baltimore, Md., U.S.A.

"Expanded polystyrene: Influence of bulk density upon physical properties," by W. B. Brown, Monsanto Chemicals Ltd., Fulmer, Bucks., Eng.

Extrusion

"Studies in the extrusion of thermoplastics," by D. A. Lannon and G. C. Karas, British Resin Products Ltd., Devonshire House, Piccadilly, London W.1, England.

"The extrusion of acrylics," by L. Griffiths, Plastics Div., Imperial Chemical Industries Ltd., Welwyn Garden City, England.

Alphabetical list of exhibitors

Non-British exhibitors' names are marked with asterisks. Numbers in parentheses indicate the stands (booths) occupied by each company. Except where otherwise noted, all addresses are in England.

A.E.R., Ltd., (507), 27-31, Upper Ground, Blackfriars, London, S.E. 1.

Aeroplastics, Ltd., (409) Earl Haig Rd., Hillington, Glasgow, S.W. 2.

Aerosol Associated Industries, Ltd., (310-314) Crewe House, Curzon St., London.

Albright & Wilson (Mfg.), Ltd., (316) 1, Knightsbridge Green, London, S.W. 1.

Alchem Processes, Ltd., (85A) 36-38, Peckham Rd., London, S.E. 5.

Aldridge Plastics, Ltd., (66) Red House Industrial Estate, Aldridge, Staffs.

Anchor Chemical Co., Ltd., (330) Clayton, Manchester 11, Lancs.

***Andouart, Ets.,** (500) 12, Rue Jean—Jaurès, Bezons (Seine-et-Oise), France.

Anglo-American Plastics, Ltd., (310-314) 1, Avery Row, Grosvenor St., London, W. 1.

Artrite Resins, Ltd., (7) 44-46, Kingsway, London, W.C. 2.

Asmidar Plastic Moulding Machines, Ltd., (10) 116, Victoria St., London.

Associated Iliffe Press, Ltd., (234) Dorset House, Stamford St., London, S.E. 1.

B.I.P. Chemicals, Ltd., (34) Oldbury, Birmingham.

B.I.P. Engineering, Ltd., (67) Streetly Works, Stutton Coldfield.

B.I.P. Tools, Ltd., (67) 147, Tyburn Rd., Erdington, Birmingham, 24.

BTR Industries, Ltd., (304) Herga House, Vincent Square, London, S.W. 1.

BX Plastics, Ltd., (71) Higham Station Ave., Chingford, London, E. 4.

Bakelite, Ltd., (35) 12-18 Grosvenor Gardens, London, S.W. 1.

Baker Perkins, Ltd., (41) Westwood Works, Peterborough, Northants.

***Bandera, Luigi,** (61) Busto Arsizio, Italy.

Barclay-Stuart (Plastics), Ltd., (102) 25-27, Brunswick St., Luton, Beds.

***Battenfeld Maschinenfabriken G.m.b.H.,** (508) Meinerzhagen-Westf., Germany.

Beanwy Electric, Ltd., (59) Rushey Lane, Tyseley, Birmingham 11, Warwicks.

Beck, Koller & Co. (England), Ltd., (217) 110, Cannon St., London, E.C. 4.

***Hermann Berstorff Maschinenbau-Anstalt G.m.b.H.,** (47, 50) Hannover, Germany.

Birkbys, Ltd., (27) Liversedge, Yorkshire.

A. Boake, Roberts & Co., Ltd., (233) Carpenters Rd., London, E. 15.

Bondway Publishing Co., Ltd., (415) Arundel Rd., Trading Estate, Uxbridge, Middlesex.

Bone Brothers, Ltd., (64) Manor Farm Rd., Alperton, Wembley, Middlesex.

Boston Marine & General Engineering Co., Ltd., (85) Viceroy Works, Low Fields Rd., Leeds, 12.

Bradley Turton, Ltd., (63) Caldwell Works, Kidderminster, Worcs.

Ed. Brand, Ltd., (83) St. Cross St., London, E.C. 1.

The Bristol Aeroplane Co., Ltd., (431) Filton House, Bristol, Gloucestershire.

British Aero Components, Ltd., (318) Montague Rd., Warwick.

British Ermeto Corp., Ltd., (200) Beacon Works, Hargrave Rd., Maidenhead, Berks.

British Geon, Ltd., (33) Devonshire House, Piccadilly, London, W. 1.

British Industrial Plastics, Ltd., (34) 1, Argyll St., London, W. 1.

British Oxygen Chemicals, Ltd., (413) Bridgewater House, Cleveland Row, St. James's, London, S.W. 1.

"British Plastics," (234) Dorset House, Stamford St., London, S.E. 1.

The British Plastics Federation, 47-48, Piccadilly, London, W. 1.

British Resin Products, Ltd., (33) Devonshire House, Piccadilly, London, W. 1. **(To page 174)**

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Grist Plastics, Ltd., (507) 82-84, Brighton Rd., Surbiton, Surrey.

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***Krauss-Maffei Akt.-Ges.**, (61) Muenchen-Allach, Germany.

***"Kunststoffe,"** (415) Carl Hanser Verlag, Munich 27, Germany.

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***Leimbach, Johann**, (47, 50) Wuppertal-Elberfeld, Germany.

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C. & C. Marshall, Ltd., (305) 1264, High Rd., Whetstone, London, N. 20.

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Mondart, Ltd., (310-314) 49, Park Lane, London, W. 1.

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***Paolo Cerini,** (507) Milan, Italy.

***Ing. S. Pastorello, s.r.l.,** (61) Via E. Breda 118, Milan, Italy.

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Prestware, Ltd., (406) Southdown Works, Kingston Rd., Raynes Park, London, S.W. 20.

***N. Previero,** (61) Via Natta 12, Como, Italy.

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Keith Prowse & Co., Ltd., (3) 90, New Bond St., London, W. 1.

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*Rezolin, Inc., (306) 1651, 18th St., Santa Monica, Calif., U.S.A.

J. W. Roberts, Ltd., (22) Chorley New Road, Horwich, Bolton, Lancs.

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*Rohm & G.m.b.H., (306) Darmstadt, Germany.

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Rubber Improvement Ltd., (414) Rilex Works, Wellingborough, Northants.

"Rubber and Plastics Age," (430) Gaywood House, Gt. Peter St., London, S.W. 1.

"Rubber Journal & International Plastics," (410) McLaren House, 131 Great Suffolk St., London.

*S.C.A.E. s.r.l., (61) Via dei Gondi 6, Florence, Italy.

S.I.C. Plastics, Ltd., (4) 12, Whitehall, London, S.W. 1.

Saro Laminated Wood Products, Ltd., (26) Whippingham, East Cowes, Isle of Wight.

H. Schubert, Ltd., (501) Imperial Works, Wenlock Rd., City Rd., London, N. 1.

Scientific Pharmacals, Ltd., (323) 1, Eden St., Hampstead Rd., London N.W. 1.

Scott Bader & Co., Ltd., (232) Wollaston, Wellingsborough, Northamptonshire.

Francis Shaw & Co., Ltd., (42) Corbett St., Ashton New Rd., Manchester, 11, Lancs.

Shell Chemical Co., Ltd., (216) Marlborough House, 15-17, Gt. Marlborough St., London, W. 1.

M. L. Shelley & Partners, Ltd., (84) Bridge Works, Wallace Rd., London, N. 1.

Sheridan Croxted, Ltd., (106) 296-302 High Holborn, London.

Siemens Edison Swan, Ltd., (66) 155, Charing Cross Rd., London.

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Simmonds Aerocessories, Ltd., (420) Treforest, Pontypridd, Glam.

H. C. Slingsby, Ltd., (87) 89-97, Kingsway, London, W.C. 2.

The Small Power Machine Co., Ltd., (93) 4, Sunleigh Parade, Alperton, Wembley, Middlesex.

Stanley Smith & Co., (77) Worple Rd., Isleworth, Middlesex.

***Soc. des Usines Chimiques Rhone-Poulenc**, (209) 21, Rue Jean Goujon, Paris, France.

***Soc de l'Electronique Francaise**, (84) 68, Boulevard Voltaire, Asnieres, Seine, France.

***Soc. Rhodiaceta, Matieres Plastiques Nylon**, (209) 45, Rue du Tunnel, Lyon 5, France.

Spa Brushes, Ltd., (300) Plastics Div., Freeman Works, Chesham, Bucks.

Spraylat, Ltd., (421A) 26, Duncan Terrace, Islington, London, N. 1.

***Stahlkontor Weser G.m.b.H.**, (47, 50) Hameln-on-Weser, Germany.

***F. J. Stokes Corp.**, (85A) 5500, Tabor Rd., Philadelphia 20, Pa.

Storey Brothers & Co., Ltd., (72) White Cross, Lancaster.

Streetly Mfg. Co., Ltd., (210) Streetly Works, Sutton Coldfield.

Styrene Products, Ltd., (33) 170, Piccadilly, London, W. 1.

Suntex Safety Glass Industries, Ltd., (429) Thorney Lane, Iver, Bucks.

***Tavannes Machine Co.**, (88) Tavannes, Switzerland.

The Telegraph Construction & Maintenance Co., Ltd., (211) Mercury House, Theobald's Rd., London.

Tellus Super Vacuum Cleaner, Ltd., (96) 39, Sheen Lane, Mortlake, London.

Temple Press, Ltd., (75) Bowling Green Lane, London, E.C. 1.

Tensile Products, Ltd., (230) Willoughby Rd., Harpenden, Herts.

Thermo-Plastics, Ltd., (81) Luton Rd. Works, Dunstable, Beds.

The Tintometer, Ltd., (94) Waterloo Rd., Salisbury, Wilts.

W. & J. Tod, Ltd., (415A) Ferrybridge, Weymouth.

***A. Triulzi, s.a.s.**, (41) Via Vialba 56, Novate, Milan, Italy.

Tudor Press, Ltd., (5) Tudor House, 75, Carter Lane, London, E.C. 4.

Tufnol, Ltd., (70) Perry Barr, Birmingham.

Turner Brothers Asbestos Co., Ltd., (207) Rochdale, Yorks.

Turner Machinery, Ltd., (57) Bramley, Leeds, 13, Yorks.

***U.S. Industrial Chemicals Co., Div. of National Distillers & Chemical Corp.**, (336) 99, Park Lane, New York 16, N.Y., U.S.A.

United Ebonite & Lorival, Ltd., (222) Little Lever, Nr. Bolton, Lancs.

Utilex, Ltd., (28) Mill St., Kingston-on-Thames, Surrey.

Vacuum Industrial Applications, Ltd., (15) Netherton Rd., Wishaw, Lanarkshire.

***Verenigd Plastic-Verkoopkantoor n.v.**, (332) Zeist, Holland.

Vinatex, Ltd., (217) Devonshire Rd., Carshalton, Surrey.

Vinyl Products, Ltd., (217) Butter Hill, Carshalton, Surrey.

Volant Brothers, (51) 7, Greenland Place, London, N.W. 1.

Wadkin, Ltd., (56A) Green Lane Works, Leicester.

***Welding Engineers, Inc.**, (503) Norristown, Pa., U.S.A.

West Instrument, Ltd., (44) 52, Regent St., Brighton Sussex.

Whiffen & Sons, Ltd., (407) Fison House, 95, Wigmore St., London.

Wickman, Ltd., (60) Banner Lane, Tile Hill, Coventry, War.

Wiggins Teape & Alex Pirie (Sales), Ltd., (307) Gateway House, 1, Watling St., London, E.C. 4.

Williams (Hounslow), Ltd., (74) Hanworth Rd., Hounslow, Midx.

Wilmot Breeden, Ltd., (214) 13-14, Oxford St., Birmingham, 5, War.

R. H. Windsor, Ltd., (36) Leatherhead Rd., Chessington, Surrey.

Yorkshire Imperial Metals, Ltd., (30) Leeds, Yorks.—**End**


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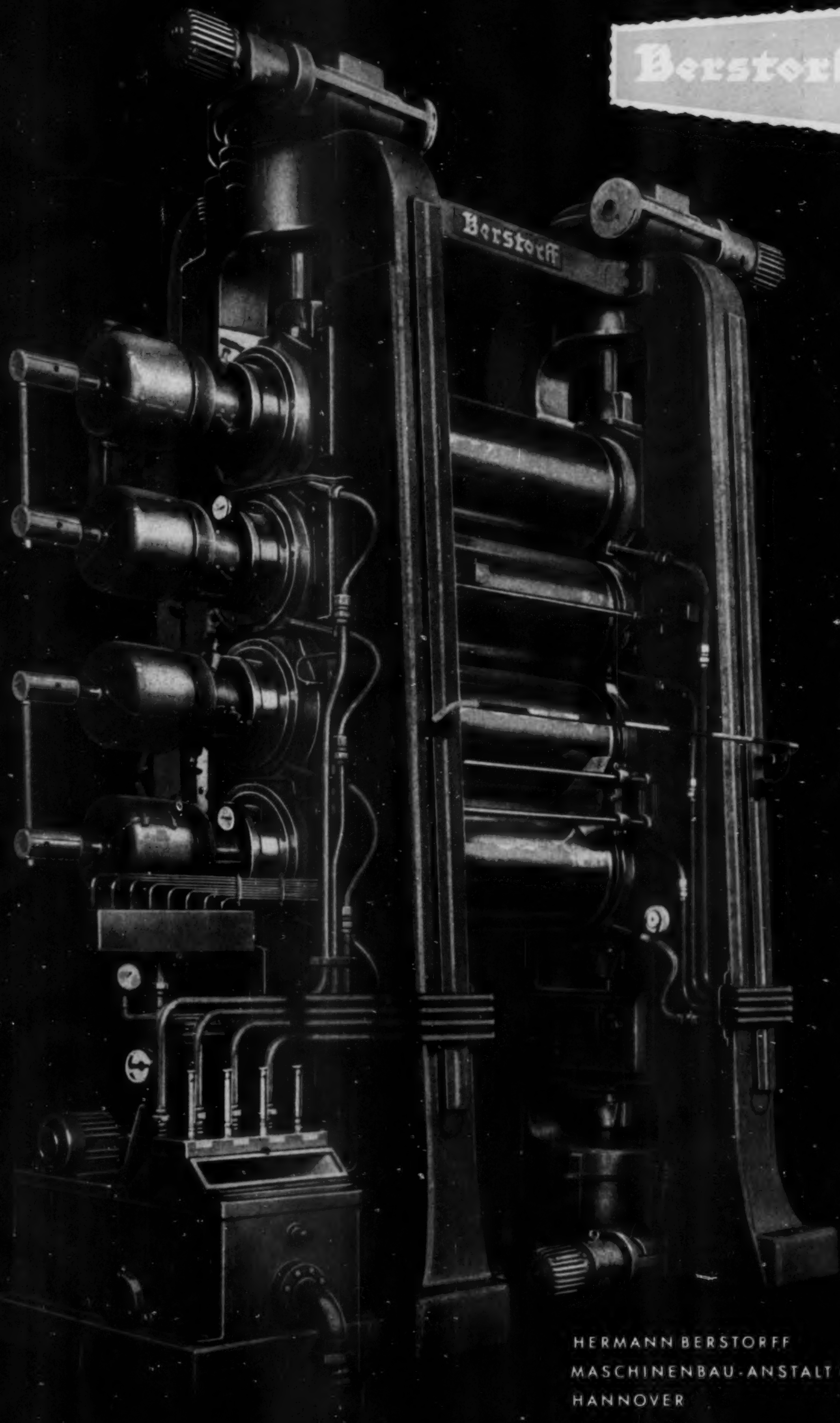
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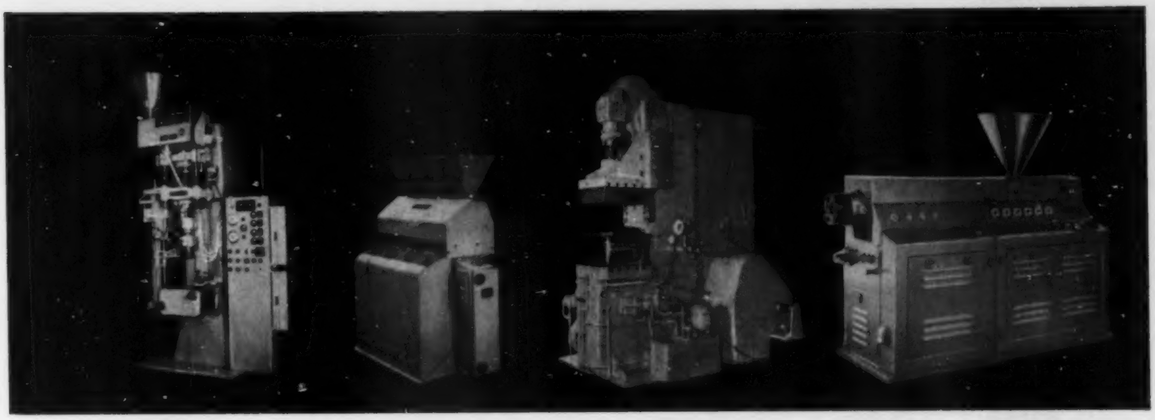
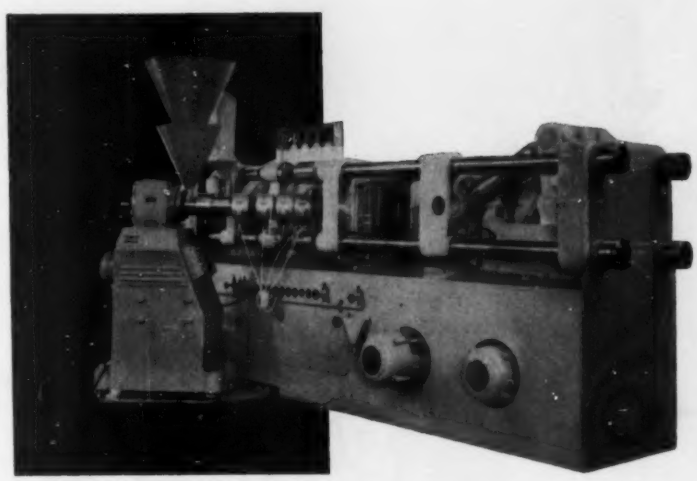




NEW DEVELOPMENTS

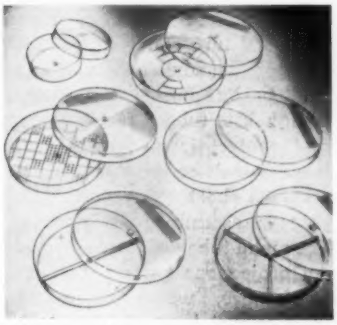
Many minds at work on new ways to use plastics, new designs, and new product concepts offer ideas you can use.

Laboratory ware

Two examples of the way in which plastics are contributing to lower cost and more efficient laboratory accessories are found in a recently announced line of disposable Petri dishes and a group of test-tube holders.

Disposable Petri dishes. So low in cost that it is actually cheaper to use them once and throw them away than to wash glass dishes, pre-sterilized Petri dishes are being offered by Fisher Scientific Co., Pittsburgh, Pa., in standard round types as well as square, radial grid, bi-plate, and tri-plate models. The dishes and covers are molded of crystal-clear polystyrene; etched area on cover provides for identification marking.

The new dishes sell for 5¢ each in 12-case lots. They are packed 20 in a sterile polyethylene bag, 500 to a case—ready to open, use, and throw away.



PRE-STERILIZED styrene Petri dishes are so inexpensive they can be used once and discarded.

Test-tube racks. More convenience and greater safety in handling test-tubes is offered by injection molded polyethylene racks made in three different sizes. The relatively soft surface of the polyethylene cushions the glass containers and is resistant to dirt and stains. Deep pockets hold the tubes upright and prevent tipping and spilling; molded-in pegs on two of the models hold clean tubes in an inverted position, making them ready for immediate use. The test tube racks are injection molded and marketed by Endicott-Seymour, Ann Arbor, Mich., using Tenite polyethylene from Eastman Chemical Products, Inc.

TEST-TUBES are conveniently and safely held in molded polyethylene racks.

Reinforced plastics pontoons for houseboat

Increased safety, lighter weight, better maneuverability, and lower price were some of the advantages gained by Boatel Co., Mora, Minn., in specifying maintenance-free styrene-foam-filled reinforced plastics pontoons for its line of houseboats. The pontoons are molded by Klapmeier Industries, Inc., Mora, using hand layup; resin is Pleogen polyester, supplied by Mol-Rez Div., American Petrochemical Corp., Minneapolis, Minn.

The pontoons are 36 in. wide, 22 in. high, and 30 ft. long. Two are used per houseboat, with each capable of supporting about 7000 pounds. Weight is approximately 50% of equivalent steel units.

Nylon arbor sleeves save time

By changing to molybdenum-disulfide-filled nylon for arbor sleeves on its printing and coating machines, Atlas Collapsible Tube Co., Chicago, Ill., was able to reduce time spent for arbor repair and replacement by over 75 percent. In addition, life of the new sleeving in operation was found to be four to five times longer on the printer and twice as long on the coater than the phenolic sleeves formerly used. Cost of the nylon sleeving, supplied with 1 in. I.D. and 1½ in. O.D., is $3.60 per running foot. Cost for similar bearing material in phenolic is about the same.

Atlas forms, coats, and prints collapsible tubes used to package tooth paste. The tolerance between the tube's internal diameter and the diameter of the arbor is critical. For one thing the tube must slide onto the arbor easily, as any drag or resistance will crumble the tube; **(To page 192)**

(From page 191)

OPERATOR at printing machine slides printed toothpaste tube off nylon arbor sleeve with her right hand; with left she slips a coated but unprinted tube onto arbor sleeve, which will carry it into printing position.

for another, the arbor must support the entire surface of the tube as it is being printed. As little as 0.005-in. wear on the arbor causes a crease in the tube.

There is no problem with lead tubes because lead is a lubricant itself, and steel arbors can be used and wear quite well. Aluminum tubes, on the other hand, require a non-metallic arbor.

For processing its annealed aluminum tubes, Atlas first turned to phenolic, then switched to nylon for the reasons stated.

In all, the switch reportedly saves the company about $2000 worth of tool room and maintenance time and adds enough extra production time to print 500,000 collapsible tubes.

Nylatron GS molybdenum-disulfide-filled nylon for this application was supplied by The Polymer Corp. of Pennsylvania, Reading, Pa.

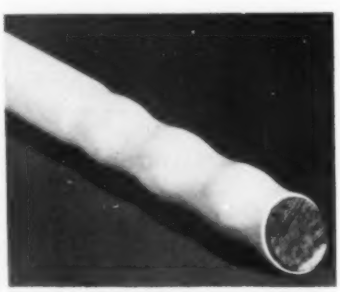
Shrink-fit tubing

A new approach to "coating" metal, wooden, or other shapes for insulation, protection, and decoration is offered by a shrink-fitting material recently introduced by Anchor Plastics Co., Long Island City, N. Y.

The material, based on acetate, is supplied as finished extruded forms—round, rectangular, or special configurations—in clear, colored, and opaque. The customer stores the shapes until needed. There is no aging, even after several years' storage, according to Anchor.

To activate the material, it is immersed in denatured alcohol and simply applied over the product. Shrinking occurs as the material dries. Parts can be handled within 30 min. after application. Maximum degree of shrinkage is about 15 percent. Wall thickness ranges from 0.010 to 1/16 inch.

Advantages of this new method are: 1) no need for heat-curing equipment; 2) typical hard acetate surface; 3) minimum labor cost. Price is comparable with regular acetate extrusions. Because shrinkage is around 15% only, the sleeving is not applicable where contour gradients are too high.



OPAQUE SHRINK-FIT tubing that has been applied over slightly contoured wood.

VACUUM CLEANER components covered with clear shrink-fit tubing; at right is shown a tubular section before application.

An interesting application for the shrink-fit tubing is in the new Lewyt electronic vacuum cleaner whose motorized beater sweeper is operated by a very low voltage (8 v.) conducted through the wand. The metal tube of the wand acts as one lead, the other is provided by an insulated metal strip inside the tube. The wand is connected to the low voltage supply through the spiral wires imbedded in the flexible hose-connection between the tank and the wand. This feature eliminates all loose wires and high voltage connections. The ends of the metal tube connectors at both ends of the flexible hose are insulated by means of Anchor Shrink-Fit tubes. This assures that contact is made only with the terminals on the tube end, and prevents short circuits when the base is assembled or removed. The metal tube ends have formed-out projections around their circumference, which causes the tubes to shrink around them, thus securely anchoring them in place.

Gallon bottles of HD polyethylene

Light weight, high strength, low cost, space saving, and ability to handle most commercial liquids are the favorable factors cited for a new gallon-size, square-shaped container blow molded of high-density polyethylene.

Produced by Plax Corp., Hartford, Conn., using Phillips' Marlex materials, the new bottle weighs only 2⅝ oz.—1 oz. less than a bottle of comparable size in low-density polyethylene and 2½ lb. less than a round gallon glass bottle. The weight reduction over low-density material is possible because the wall section can be made thinner yet still result in a container that is virtually unbreakable. Because of the strength of the container, thinner corrugated board with less tare weight can be used for packing; because of its square shape, it

takes up 37% less space than a round gallon bottle, and shipping and warehousing costs are reduced still further. John H. Breck, Inc., leading manufacturer of

shampoos and other hair care preparations, estimates that it will save $23,000 this year in shipping costs by using the containers.

Products already being packaged in the new Plax gallon bottles range from arsenic acid, disinfectants, and hydrofluoric acid to cosmetics, inks, laundry and cleaning fluids, shampoos, and pharmaceuticals.

Price checker

Created for self-service shopping, a new miniature adding machine with a housing molded of high-impact styrene enables shoppers to keep a running total of the cost of items selected before reaching the check-out counter. Easily operated by one hand, the push-button device, known as Quik-Chek, leaves the other hand free to handle merchandise.

The manufacturer, Clicker, Inc., Brockton, Mass., required a hous-

ing that would be strong enough to protect the precision internal mechanism and colorful to appeal to shoppers. The material selected was a modified styrene from Union Carbide Plastics Co., a Div. of Union Carbide Corp.

Acid bottle

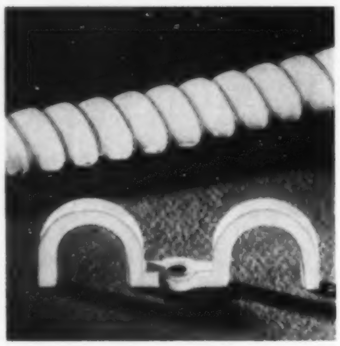
High-density polyethylene is now being used successfully in a container-dispenser for hydrofluoric acid, an important industrial chemical that cannot be retained in glass.

The new container, produced by Plax Corp., Hartford, Conn., for Mallinckrodt Chemical Works, has a special dispensing spout that can deliver the acid, by squeezing or pouring a drop at a time or in a steady stream. Any acid remaining in the spout is sucked back into the unbreakable bottle. A screw-on closure safety seals the spout.

The rigidity of the container makes it virtually impossible to release the contents by accidental squeezing. The translucent bottle shows the liquid level clearly and the label is printed directly on the container.

Cable clamps

Uniform strength and density, plus excellent electrical insulating properties, are realized in a cable clamp manufactured of Plaskon alkyd molding material by Pribble Plastics Products, Inc., New Haven, Ind., for use on terminal boards of electronic computers made by Burroughs Corp., New York, N. Y.



Designed to secure two electric cables at once, the clamps are molded in the form of a double arch and are fastened in place by a single screw.

Production economies are claimed for these clamps, because of ease of handling and speed of molding of the material. The clamps can be color-matched with the terminal boards, which are made of the same material.

Disposable syringes

Application of bonding agents, potting compounds, etc., is made easier by the use of a simple low-density polyethylene two-part syringe, recently announced by Carl H. Biggs Co., Los Angeles, Calif. An outstanding feature of the syringe is its tapered tip in which the ID follows the taper of the OD. Thus the user can cut back the tip to enlarge the orifice for fluids of any viscosity or to increase the rate of delivery.

In use, the barrel of the syringe is filled, the plunger inserted, and the fluid dispensed quickly by simple thumb pressure, without waste or drip. The flexibility of the polyethylene eliminates the need for rubber or other gaskets.

Molded by Rakar Co., W. Los Angeles, the syringes are inexpensive enough ($3.50 per doz.) to be thrown away when in need of cleaning. They are also suggested for decorating ceramic ware and bakery goods, injecting spices into meats, applying permanent wave solutions, assembling hobby kits, calking, etc.—**End**

LITERATURE

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"The Rheology of Elastomers," *edited by P. Mason and N. Wookey.*

Published in 1958 by Pergamon Press Inc., 122 E. 55th St., New York 22, N.Y. 202 pages. Price: $8.50.

This is a collection of 14 papers—and the discussions thereof—presented at the May 1957 meeting of the British Society of Rheology. Titles: Present status of the theory of large elastic deformations; Thermodynamics of rubber in extension; Photo-elastic properties of rubber-like polymers; Elasticity of gelatin gels; Experimental study of stress relaxation and viscous flow in natural rubber; Network theories of stress relaxation and set in rubber; Theory of elastic recovery in concentrated solutions of elastomers; Temperature-frequency relationships of dielectric and mechanical properties of polymers; Tearing of rubber; Mechanical properties of irradiated filled rubber; Dynamic visco-elasticity of polyester cured by irradiation; Recovery behavior of polyethylene at large strains; Elastic effects in the extrusion of polythene; High-temperature tensometry and its application to amorphous polyethylene terephthalate.

"Plastics, Lacquer, and Rubber Analysis," *by Dieter Hummel.* (In German).

Published in 1958 by Carl Hanser Verlag, Kolbergerstrasse 22, Munich 27, Germany. In two volumes totaling 592 pages. Price: 148 DM (about $35).

Volume I is a detailed textbook of analysis of resins (natural and synthetic), waxes, oils used with resins, rubbers, solvents stabilizers, plasticizers, vulcanizing agents. Chapters discuss sample preparation, physical methods, chemical group reactions, properties and identification of macromolecular raw materials and oils used in coatings, P & I of auxiliary materials used with resins, detailed examples of procedures for several important classes of resinous materials. There are over 750 literature references, mostly from the 1950s through 1957.

Volume II is composed entirely of 549 infra-red spectra of these materials as measured on a Model 21 Perkin-Elmer IR Spectrometer, printed big and clearly enough to confidently read transmittance to 1% on the 0 to 100% charts on which most of the spectra were recorded. Spectral range is 2 to 15 microns, readable to 0.05 micron.—*J.F.C.*

Polyurethane elastomer. General properties, tensile strength and elongation, hardness, resilience properties, tear strength, thermal and high-temperature properties, flex characteristics, abrasion resistance, electrical and radiation properties, uses, etc., of Disogrin, a solid polyurethane material. 24 pages. *Disogrin Industries, Inc., 510 S. Fulton Ave., Mount Vernon, N. Y.*

Plugs, caps, and flanges. Sizes, dimensions, prices, etc., for a line of plastics plugs, caps, and flanges. 4 pages. *Niagara Plastics Co., P. O. Box 98, Erie, Pa.*

Vinyl-metal laminate. Tensile strength, thickness, elongation, tear, grain retention, abrasion resistance, uses, etc., of Cladplate, a semi-rigid vinyl bonded to steel, aluminum, wood composition board, etc. 8 pages. *North-East Laminates, Inc., Industrial Park, Lowell, Mass.*

PVC pipe. General characteristics, dimensional data, properties, uses, corrosion resistance, recommended working pressures, etc., of polyvinyl chloride pipe. 32 pages. *A. M. Byers Co., Clark Bldg., Pittsburgh 22, Pa.*

Aluminum pigments. Product information on a line of aluminum pastes and powders for the plastics industry. 6 pages. *Silberline Mfg. Co., Inc., Stamford, Conn.*

Containers. Describes various types of reinforced plastics shipping and storage containers available. 4 pages. *Harco Containers, 258 Cannery St., Terminal Island, Calif.*

Variable speed drives. Features, speed variations, controls, etc., for a line of variable speed drives for the plastics and other industries. Bulletin G-5812. 8 pages. *Reliance Electric & Engineering Co., 24701 Euclid Ave., Cleveland 17, Ohio.*

TFE tubing. Physical and electrical properties, size range, etc., for extruded Teflon spaghetti and flexible thin-wall tubing. 4 pages. *Continental-Diamond Fibre Corp., Newark, Del.*

Urethane foam. "Urethane Makes the Sale" is designed to acquaint the furniture industry with the sales potential of urethane foam. 20 pages. *National Aniline Div., Allied Chemical Corp., 40 Rector St., New York 6, N. Y.*

A Study on the Effects of High Aromatic Fuels on Elastomers. Report based on the results of a recent laboratory study. 12 pages. *Thiokol Chemical Corp., 780 N. Clinton Ave., Trenton 7, N. J.*

Vinyl grommets. Specifications, uses, etc., for flexible vinyl grommets. 1 page. *L. M. R. Engineering Corp., Clayton P. O. Box 106, St. Louis 5, Mo.*

Resins for coatings. Physical properties, grades, resin formulations, test methods, etc. for Duraplex and Amberlac, which are alkyd-type resins (26 pages); Paraplex, resin plasticizers (14 pages); and Acryloid, acrylic ester resins (18 pages); for coatings. . . Amberol-Amberlac, phenolic and maleic resins for varnishes, nitrocellulose lacquers, and printing inks (34 pages) . . . and Uformite, urea, melamine, and other triazine formaldehyde resins for finishes (22 pages). *Rohm & Haas Co., Resinous Products Div., Philadelphia 5, Pa.*

Polyester resins. "The Chemical Resistance of Cellobond Polyester Resins, Laminates and Casts." 6 pages. *British Resin Products, Ltd., Devonshire House, Piccadilly, London W-1, England.*

Temperature controllers. Types, dimensions, description, temperature range, special features, etc., for a line of Thermoswitch temperature controls and mounting wells. Bulletin MC-177. 8 pages. *Fenwal, Inc., Ashland, Mass.*

Vinyl foam. "Vinylfoam, a Better Product at a Lower Price" gives physical properties; tests; uses; change in compression deflection characteristics of vinyl foam, foam rubber, polyether urethane and polyester urethane after **(To page 199)**

humid aging; and other data. 16 pages. *Union Carbide Plastics Co., 420 Lexington Ave., New York, N.Y.*

Insulating tape. Characteristics, sizes, uses, etc., for Atlas asbestos and Glaspun woven tapes for plastic reinforcement, plastic laminating, etc. 2 pages. *Atlas Asbestos Co., North Wales, Pa.*

Printing on Plastics. Describes various screen process printing colors for decoration of plastics. 6 pages. *Wornow Process Paint Co., 1218 Long Beach Ave., Los Angeles 21, Calif.*

Polymers and Resins ... their Chemistry and Chemical Engineering. A comprehensive volume that covers the theory, chemistry, properties, manufacture, fabrication, and application of all commercial polymers and resins. 750 pages. Price: $15.00. *D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J.*

Styrene. General and electrostatic properties, applications, molding and post-molding operations, product characteristics, etc., for Lustrex Lo-Stat styrene. 8 pages. *Monsanto Chemical Co., Plastics Div., Springfield 2, Mass.*

Isobutylene. Chart depicting the isobutylene "family tree" and showing present commercial uses and all reported reactions having potential new-product significance. Includes 213-item bibliography. *Petro-Tex Chemical Corp., P. O. Box 2584, Houston 1, Tex.*

Dioctyl sebacate. Physical properties, electrical data, specifications, etc., for dioctyl sebacate, a sebacic acid ester used as a plasticizer for conferring to polyvinyl chloride. Bulletin 116. 3 pages. *Harchem Div., Wallace & Tiernan, Inc., Box 178, Newark 1, N. J.*

Silicone rubber. Applications, limitations, storage stability, properties, curing, mixing, and other technical data on RTV (room temperature vulcanizing) silicone rubber compounds. 10 pages. Bulletin CDS-170. *Chemical & Metallurgical Div., Silicone Products Dept., General Electric Co., Mechanicville Rd., Waterford, N. Y.*

Millivoltmeters. Operating principles, specifications, features, etc., for a line of non-control and control millivoltmeters, which are useful for measuring temperatures in thermocouples. Catalog C10-1 (Supersedes Catalog 1054). 28 (To page 200)

pages. *Industrial Div., Minneapolis-Honeywell Regulator Co., Wayne & Windrim Aves., Philadelphia, Pa.*

Movie. A 25-min., 16mm. color and sound motion picture depicts the manufacture of Wheelabrator Steel Shot from scrap selection to packaging methods. Available for program material with or without a company spokesman. *Abrasives Div., Wheelabrator Corp., 1254 S. Byrkit St., Mishawaka, Ind.*

Epoxy-polyamide repair material. Advantages, mixing instructions, curing characteristics, applications, prices, etc., of Plastic Mastic, an epoxy-polyamide chemical compound for general repairs. 11 pages. *Williamson Adhesives, Inc., 8220 Kimball Ave., Skokie, Ill.*

Valves. Types, specifications, etc., for a line of manual, foot-operated, and solenoid valves for oil, water, and air, including 4-way, 3-way, shut-off, and diverter valve series. Range to 10,000 p.s.i. Catalog 59-60. 20 pages. *Barksdale Valves, 5125 Alcoa Ave., Los Angeles 58, Calif.*

Nylon parts. Property and application data on a line of Nylasint sintered nylon parts. 4 pages. *Halex Corp., 2120 Fairmont Ave., Reading, Pa.*

Diphenolic acid. Formula, synonym, physical properties, uses, typical reactions, etc., for diphenolic acid, a chemical intermediate for the plastics and other industries. 10 pages. *Service Products Div., S. C. Johnson & Son, Inc., 1525 Howe St., Racine, Wis.*

Epoxy resins. Features, application, working instructions, physical properties, etc., for Maraset epoxy resins. 2 pages. *Marblette Corp., 37-31 Thirtieth St., Long Island City 1, N. Y.*

Polyester glass. Physical, mechanical, and electrical properties; uses; grades; etc., of polyester glass-base Dilecto and Celoron laminates. 4 pages. *Continental-Diamond Fibre Corp., Newark, Del.*

Molding compounds. Properties, uses, engineering data, etc., for a line of reinforced molding compounds. Bulletin 10. 4 pages. *The Fiberite Corp., Winona, Minn.*

Finishing and Decorating. Inplant training booklet dealing with the finishing and decorating of plastics products. Booklet was developed by the Educational Committee of

SPI. 36 pages. *The Society of the Plastics Industry, Inc., 250 Park Ave., New York 17, N. Y.*

Polyester. Formulation, mixing, curing, general constructions for making foams, physical properties, etc., of Pleogen 4002, a polyester used in preparing rigid polyurethane foam. Technical Bulletin 27. 5 pages. *Mol-Rez Div., American Petrochemical Corp., 3134 California St., N. E., Minneapolis 18, Minn.*

Polystyrene latex. Typical properties, film properties, techniques of film formation, applications, shipping and storage, etc., of Dow Latex 586, a polystyrene latex for plastics and coatings uses. 4 pages. *Plastics Merchandising-2, The Dow Chemical Co., Midland, Mich.*

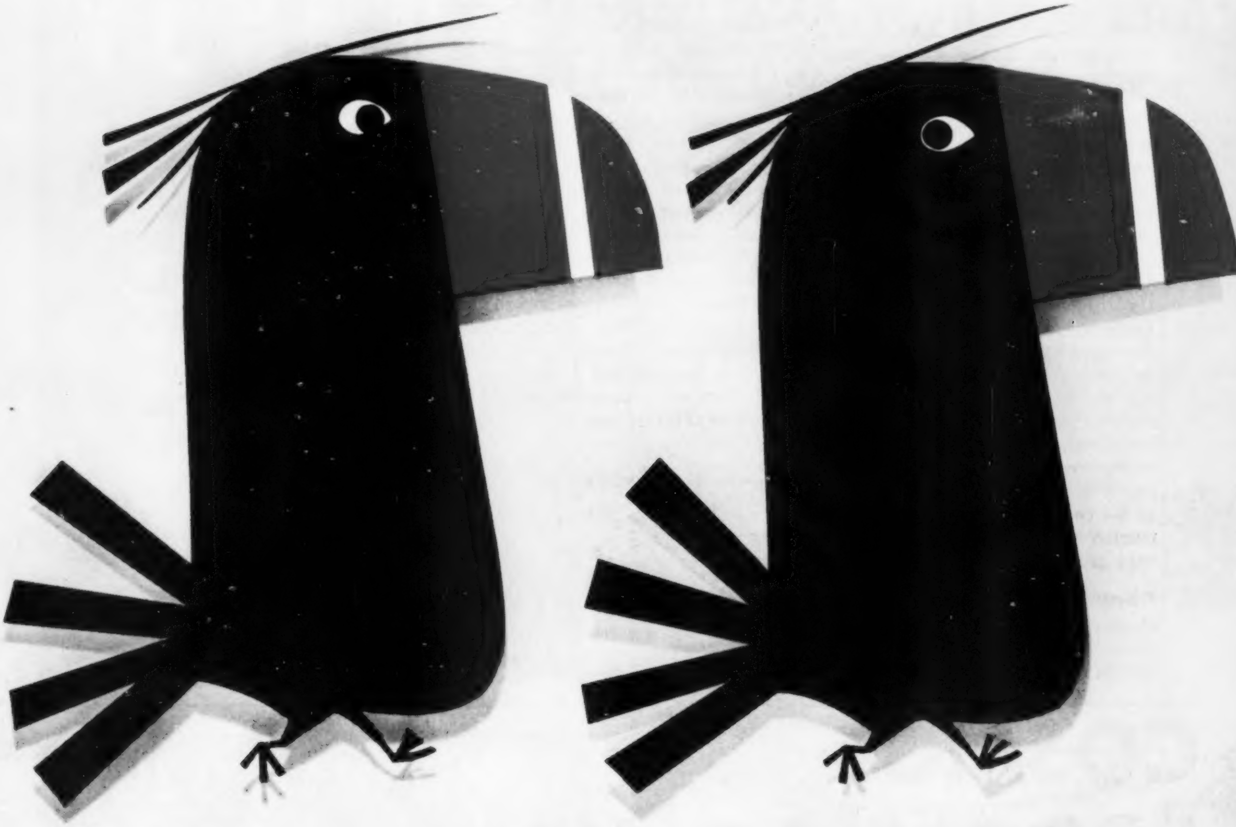
Synthetic waxes. Forms available, compatibilities, electrical properties, solubilities, uses, etc., for a line of synthetic waxes for plastics, adhesives, coatings, etc. 18 pages. *Glyco Products Co., Inc., Empire State Building, New York 1, N. Y.*

Dispersions. "New Kenmix Dispersions" describes several new accelerator and catalyst dispersions which have been developed based on Kenflex resin. 8 pages. *Kenrich Corp., 57-02 48th St., Maspeth 78, N. Y.*

Polyether catalyst. Foam formulation, foam preparation and machine conditions, physical properties, toxicity, and other technical data on Dabco, a one-shot polyether catalyst for producing urethane foams. Data Bulletin 3. 20 pages. *Houdry Process Corp., 1528 Walnut St., Philadelphia 2, Pa.*

Epoxy resin tool and pattern making motion picture. "How-to-do-it" sound, color, 16mm., 36-min. film featuring shop applications of epoxy tooling resins. Illustrates speed obtainable with Epoxical tooling resins in step-by-step demonstrations showing laminating and casting of foundry patterns, metal forming dies, etc. Free showings available. *Dept. 139, U. S. Gypsum Co., 300 W. Adams St., Chicago 6, Ill.*

Plastics guide. "Guide to Use of Plastics in Production, Maintenance, and Safety Applications," measuring 8½ by 11 in., includes selection guide for selecting right type plastic for specific applications; offers hints for proper storage and care of plastic sheets, rods, and tubes; etc. *Commercial Plastics & Supply Corp., 630 Broadway, New York, N. Y.*—**End**



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Plastics Digest

(From page 58)

specimen is a small ring. Segments of ring may be tested in flexure or shear, and entire ring can be tested in tension or flexure. The specimen also appears adaptable to the measurement of the internal damping coefficient. The flexural test with specimens made of polyester and epoxy resins is sensitive to fiber finish. The proper environmental conditioning (wet) must be considered as an integral part of the test.

Design and performance of a block-type osmometer. D. McIntyre, G. C. Doderer, and J. H. O'Mara. J. Research NBS 62, 63-66 (Feb. 1959). A block-type osmometer was designed and constructed utilizing several new features which enhance the precision of the osmotic-pressure measurement and allow simpler manipulative techniques. The details of the construction as well as a discussion of the design and performance are given.

Chemistry

Grafting modifies fluorocarbons. Chem. Eng. News 37, 44-45 (Feb. 2, 1959). The effects of graft polymerization to modify the surface properties of fluorocarbons are described.

Kinetic studies of α-olefin polymerization. G. Natta. J. Polymer Sci. 34 21-48 (Jan. 1959). The kinetics of chain growth and chain transfer processes in the stereospecific polymerization of propylene, using catalytic systems such as $—TiCl_3—Al(C_2H_5)_3$ and $—TiCl_3—AlCl(C_2H_5)_2$, are examined. The number of active centers present on the catalyst surface is determined radiochemically by kinetic and adsorption measurements, using aluminum labeled with C^{14}. The mean life of macromolecules is determined by radiochemical determination of terminal groups and the relationships that were found to exist between intrinsic viscosity and number-average molecular weight are reported.

Publishers' addresses

Adhesives Age: Palmerton Publishing Co., Inc., 101 W. 31st St., New York 1, N. Y.

A.S.T.M. Bulletins: American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.

Astronautics: American Rocket Society, 500 Fifth Ave., New York 36, N. Y.

British Plastics: Iliffe and Sons, Ltd., Dorset House, Stamford St., London S.E. 1, England.

Chemical Engineering News: American Chemical Society, 1155 Sixteenth St., N.W., Washington, D. C.

Chemical Reviews: American Chemical Society, 1155 Sixteenth St., N.W., Washington, D. C.

Chemical Week: McGraw-Hill Publishing Co., Inc., 330 W. 42nd St., New York 36, N. Y.

Chimie et Industrie: Presses Documentaires, 28 Rue Saint Dominique, Paris 7, France.

Industrial and Engineering Chemistry: American Chemical Society, 1155 Sixteenth St., N. W., Washington 6, D. C.

Industrial Laboratories: Frank D. Thompson Publishers, 201 N. Wells St., Chicago 6, Ill.

Insulation: Lake Publishing Co., 718 Western Ave., Lake Forest, Ill.

Ion: Revista Espanola de Quimica Aplicada, Paseo del Prado 18-20, Madrid, Spain.

Journal of Polymer Science: Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y.

Journal of Research of the National Bureau of Standards: Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Kolloid Zeitschrift: Verlag Dr. Dietrich Steinkopff, Holzhofallee 35, Darmstadt, Germany.

Kunststoffe: Carl Hanser Zeitschriftenverlag, G.m.b.H., Kolbergerstr. 22, Munich 27, Germany.

Magazine of Standards: American Standards Assn., Inc., 70 E. 45th St., New York 17, N. Y.

Materials in Design Engineering: Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y.

Metal Finishing: Metals and Plastics Publications, 381 Broadway, Westwood, N. J.

Modern Packaging: Modern Packaging Corp., 575 Madison Ave., New York 22, N. Y.

Plastics Institute Transactions & Journal: The Plastics Institute, 6 Mandeville Place, London W.1, England.

Plastics Technology: Bill Brothers Publishing Corp., 386 Fourth Ave., New York 16, N. Y.

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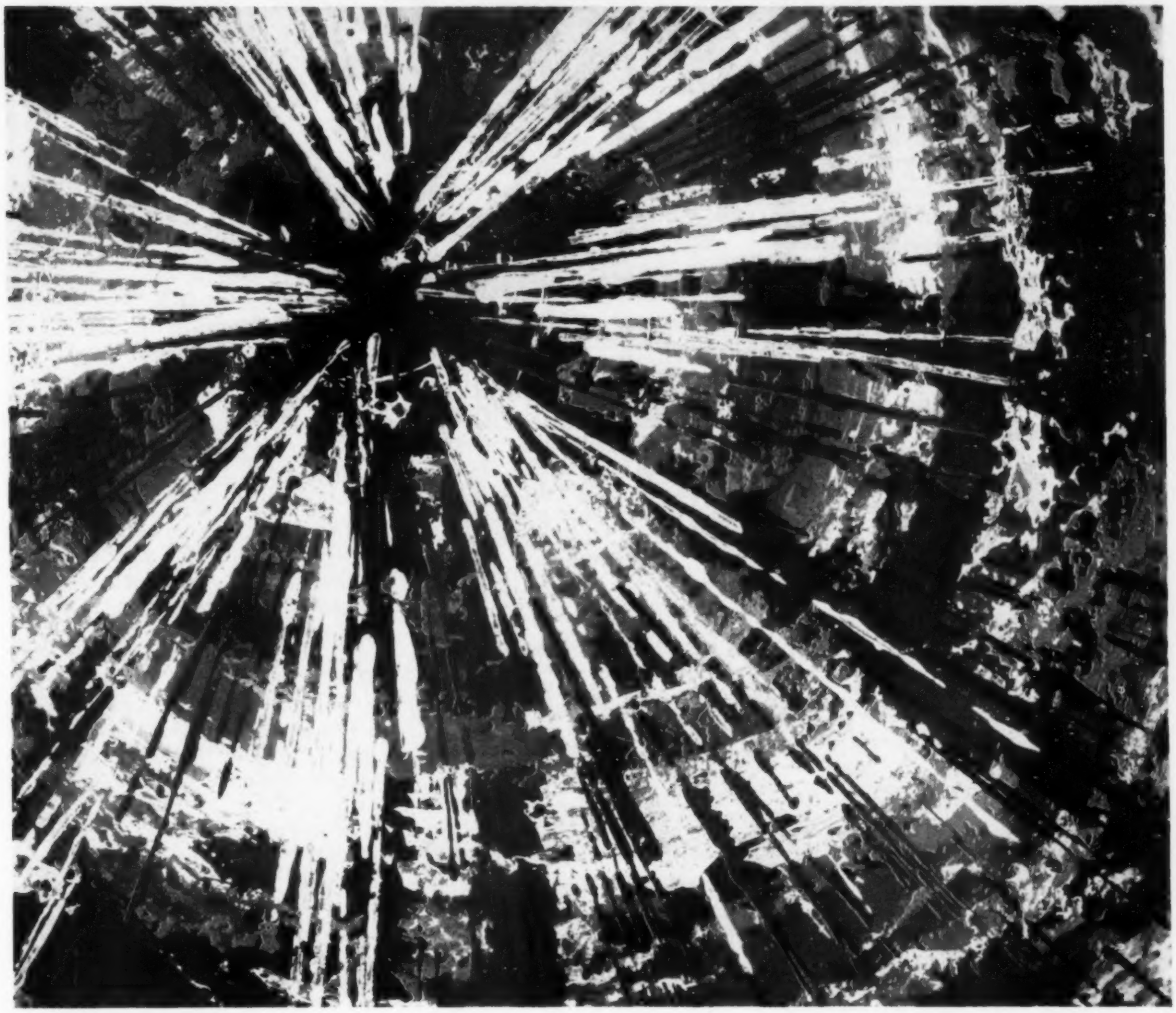

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Sprayup

(From pp. 85-89)

impractical by hand layup because of the problem in patterning of woven or mat materials. Considerable time can be saved if planned production techniques are employed for spraying and roll-out. For example: to sprayup a five-sided container, place five identical molds, equally separated, on a rotary table so that each mold side passes under the Depositor once, with roll-out stations between."

Rand Depositors, manufactured under patents held by Canadian Ingersoll Rand, are licensed to users on a royalty basis; training courses for operators are offered for a small additional fee.

Fiberlay, Inc. This company's sprayup unit, called the Spray Molder, projects continuous glass roving onto the mold surface, together with resin mixes from a two-nozzle gun. The equipment, provided on an outright sale basis, consists of a two-nozzle resin mixing gun, a fiber-propelling nozzle for feeding the roving, a fourth nozzle for aggregate (filler), all necessary controls, an aggregate hopper, and a boom for holding the gun. Only an air compressor is needed to put the unit into operation.

Says Pres. Marvin E. Carr of Fiberlay: "We do not believe it is desirable to chop the fiber into short lengths. We spray a continuous length to realize the increased strength that longer fibers may provide. By using a continuous strand, we are able to orient the fiber in unidirectional fashion for controlled strength, to maintain control over the 'roping' effect, and to eliminate the problem of replacing chopping apparatus that may wear or become defective. Furthermore, the Spray Molder is entirely air operated. Because there are no electrical connections, there is no possibility of sparks that might cause explosion."

Fiberlay makes a big point of its claim that the Spray Molder can handle low cost aggregates as fillers for molded parts. These include sawdust, sand, gravel, expanded mica, ground cork, etc. Also, it is stated, the gun can

spray liquids of any viscosity—polyesters, epoxies, and even asphalt emulsions or hot tar.

Speed of sprayup of reinforced plastics by the Spray Molder is reported to be about 16 lb. of 33⅓% glass laminate per minute, but operator limitations hold the figure about 1.7 lb. of completed product per man-minute.

Hupp Engineering Associates. Sprayup equipment supplied by Hupp consists of two separate units: a glass breaker and a resin depositor composed of two spray heads which are mounted about 4 in. apart.

The resin-spraying units manufactured by Hupp use standard and Hupp-modified parts furnished by Paasche. In operation, the resin is applied to the mold surface, immediately followed by the correct amount of glass and another spray of resin. Each application is followed by thorough rolling to work the glass and resin together. Control of glass and resin deposition is by electric timers.

Speed of application by the Hupp system is stated to be up to 19 lb./min. of 33⅓% glass laminate.

Hupp also emphasizes the need for training operators in the sprayup process by including an instruction course for technicians with each sale.

A. Gusmer, Inc. The Gusmer system is designed specially for sprayup of reinforced epoxy resins, where short pot-life has long been a handicap. In the Gusmer system, the epoxy resin and hardener, gear-pumped at high pressure from separate containers, meet in the mixing chamber of the gun. (See MPL, Nov. 1958, p. 254, for a description of this gun.) Here they are swirled together and then projected from the nozzle in the form of tiny droplets. A separate glass chopper, made by I. G. Brenner Co., Newark, Ohio, is used to feed chopped roving into the resin spray.

To maintain the resin and hardener at a constant viscosity suitable for spraying, the two components are fed to the gun through heated hoses. Resistance wires in the hoses, connected to a 115-v. supply, maintain a temperature of 190 to 225° F., depending on viscosity desired.

Peterson Spray Gun Co., Inc. By combining a twin-tip spray gun with a glass breaker called the Glass Hog, Peterson has produced a sprayup system which, it is claimed, will lay down 9 lb. of ⅓-glass laminate per minute.

The twin-tip Peterson resin gun, using standard parts supplied by DeVilbiss Co., Toledo, Ohio, is offered either alone or with the Glass Hog attachment.

How costs are cut

Aside from labor saving through faster production of contact or bag molding layup, the sprayup method uses fibrous glass in an inexpensive form and reduces glass and resin waste to a minimum. Glass roving costs about 40¢/lb. as compared with mat at 50 to 55¢/lb. and cloth or woven roving at much higher prices. On a job where a 5% waste of glass mat was considered normal for hand layups, waste dropped to ½% for sprayup using chopped roving.

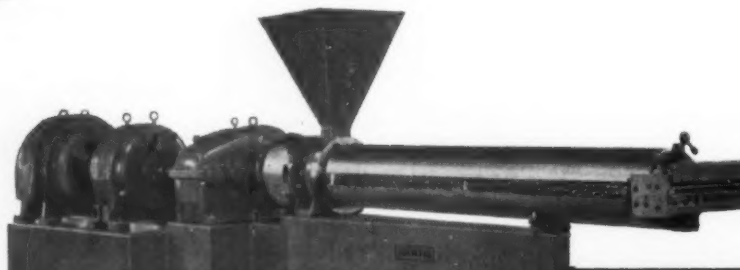
Resin waste is also materially reduced because the catalyzed and promoted resins are never mixed until they are deposited. Premature setting up is eliminated, as is also the waste of resin on the sides of small containers and on the brushes normally used in hand layup.

Better working conditions, too

In many minds, sprayguns are linked with a penetrating fog surrounding the operation, with spray booths, masks for the workers, and generally with unpleasant shop conditions. With sprayup guns handling polyesters (epoxies require some special precautions), these factors do not pertain. The resin components are projected, usually by hydraulic pressure, in the form of tiny droplets; extreme atomization is undesirable because of evaporation of volatile styrene. Ventilating requirements for sprayup are no greater than for conventional hand layup of glass and resin.

In addition, since the sprays of resin and glass are constantly under the operator's control, shop floors and walls, fixtures and other tools, and (To page 214)

PACKAGED HARTIG EXTRUSION



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the workers stay cleaner. A trained operator can hold over-spray to a minimum and that little can be taken care of by tricks in mold design.

In the case of spraying epoxies, even though misting is avoided, the hardeners are often irritating to the skin. Adequate personnel protection must be provided to prevent contact with air-borne droplets. Respirators, gloves, goggles, and the like should be considered and a suitable protective cream should be applied to exposed skin areas. In the meantime, research is being aimed at developing minimum-irritation materials.

A word of caution

While the sprayup process holds tremendous potential for expanding the uses of reinforced plastics and reducing production costs in many existing applications, it has its limitations. Many smaller and complicated moldings cannot be satisfactorily laid-up by the guns. Glass mat will still have its uses and, where applications demand the physical properties of glass cloth, it will be used.

Matched metal molding, too, is still very much in the picture. It can often do jobs that are impossible or uneconomical to do otherwise. In fact, making of preforms for matched metal molding may well benefit from new knowledge of roving and fiber handling and resin spraying, acquired as sprayup equipment and techniques are further developed and refined.

It should also be re-emphasized that sprayup operation is not to be lightly undertaken. Despite built-in timers and other controls, success or failure of a given job rests largely in the experience and skill of the men who trigger the guns. But once this experience has been acquired, sprayup users invariably report remarkable reproducibility of standards from piece to piece.

The sprayup process is definitely established as a mass-production tool. It is worthy of intensive study by everyone connected in any way with reinforced plastics . . . and anyone who would like to be.—**End**

School seats

(From pp. 90-92)

back rest. Both units are made in two sizes to accommodate students in all age ranges. Seat components are molded in single cavity molds and the backs in two cavity molds; both are produced on 48-oz. Watson-Stillman injection machines.

According to a spokesman for the manufacturer, cycle and mold temperatures are critically maintained when producing these parts in order to avoid possible sink marks in the heavy rounded edges. Special cooling fixtures were designed to insure that the parts—particularly the relatively large seat components—maintain required contours following removal from the mold. This is particularly important to insure a proper fit when the polyethylene components are assembled to the steel framework.

As illustrated in an accompanying photo (p. 91), the seats are ribbed on the underside for increased strength and have four holes through which they are riveted to the metal frame of the Study-Center. The back rest components (see same photo) are designed with a "pocket" in the back, produced by a side core in the mold, which conceals four cored bosses for attachment of the piece to the tubular metal back supports. This arrangement gives the assembly a smooth, finished appearance and also discourages disassembly of the back by prying fingers in class.

Accelerated test program

Because schools—particularly in the lower grades—are recognized as one of the toughest proving grounds for furniture, American Seating subjected the new seats and backs to a series of rigorous laboratory tests before giving them the production green light. Tests were set up to condense into a few weeks simulated service of 30 years as a minimum performance standard.

The tests included a ball drop impact test, in which a 2.3-lb. metal ball is dropped on the seat from a height of 7 ft.; another impact test in which a 40-lb. sandbag is dropped repeatedly on the seat; a swinging impact test, with two 40-lb. suspended sandbags hammering against the front and back of the back rest component, and a weatherometer test to check the resistance of the colors and the material itself to deteriorating ultraviolet light rays. The parts came through this series of tests with flying colors.

Another application of high-density PE by American Seating is in molded arms for the teacher's chair used with the company's Electronic Teaching Center, a "desk" incorporating advanced teaching aids under push-button control by the instructor. The chair also incorporates molded vinyl foam back rest and seat cushions which are covered with a rough-textured rayon and linen fabric.

Laminate tops

The L-shaped 4- by 8-ft. top of the Electronic Teaching Center, like that of the Study-Center

and other desks and tables manufactured by American Seating, consists of wood-grain melamine laminate.

These tops, described by the company as five times as wear-resistant as wood surfaces, are produced by American Seating on its own press equipment, using pre-impregnated materials supplied by Fabricon Products, a division of Eagle-Picher Co., River Rouge, Mich. Bonded to a wood particle core, the tops will not warp, check, or split and are highly resistant to staining or marring. Their light reflectance, controlled at between 40 and 50% for maximum eye comfort, is achieved by the surfacing of the press platens, rather than by a sanding operation after removal from the press. The effect of this matte type finish is to make the tops undistinguishable from finished wooden surfaces—but students trying to carve their initials in it are going to be sadly disappointed.

What is the market picture?

Plastics' potential in the school furniture field may be crystallized in a few eye-opening statistics, which emphasize the need for sturdier, more efficient, more economical student seating to eliminate costly maintenance. Recently published figures, not attributable to American Seating, show that, in 1958, 71,600 new classrooms were constructed in the U. S.; and school administrators foresee a 3% increase during the current year. Total classrooms at the beginning of 1959 was 1,233,000; but according to the U. S. Department of Health, Education and Welfare, there is a current shortage of 140,500 classrooms.

With total elementary and high school enrollment expected to increase approximately 12 millions in the next 10 years, polyethylene can be expected to find the school furniture field an increasingly important market outlet. What is perhaps even more significant, success of high-density polyethylene in the schools may well open the consumer seating field to the material—which would mean a truly staggering market.—**End**

Blow molding PE

(From pp. 107-114)

wall thickness assuming equal weight per unit length.

All of the data taken together lead to these generalizations:

1) Resin melt index is without appreciable effect on minimum cooling time.

2) Increasing resin density decreases the cooling time required to make a bottle free of distortion. This is a consequence of the higher melting points of these resins and the greater difference between melting point and "neck-distortion" temperature.

3) On a per-degree basis, changes in mold and material temperature have comparable effects on minimum cool time.

Rough estimates of the cooling cycles required for bottles can be made from the following findings: The base condition is a material temperature of 300° F., a mold temperature of 80° F. and a neck thickness of 120 mils (wall thickness—50 mils). At this base condition the 0.920-density resins cool in 15 sec., while only 10 sec. are required for 0.950-density material. Every 100° F. increase in mold or material temperature or combination of the two, increases the cooling time required 50 percent. Every 25-mil increase in neck thickness, increases the cooling time by 35 percent.

The effect of increasing air pressure is illustrated in Fig. 12. It will be noted that at low pressures the effect of increasing air pressure is marked while at the higher pressures the effect is nil. The pressure required to obtain optimum cooling is greater with high-density resin because of higher shrinkage and greater rigidity. A blowing air pressure of 60 p.s.i. was sufficient to obtain optimum cooling with all resins tested.

From the above it is clear that, from the production rate point of view, it is desirable to run the mold and material temperature as low as possible. The limits on how low these can be run are determined by the bottle quality factors involving 1) Appearance; 2) welding efficiency at the seal; 3) wall thickness uniformity; and 4) shrinkage. These will be discussed in Part 2.—**End**

Premix

(From pp. 115-124)

service. Repeated cycling from a warm oven to a cold refrigerator, for instance, would be more realistic for most cases than plunging into super-cooled acetone.

Transfer molding

Cracking problems constitute the chief obstacle to widespread application of the transfer molding technique to the long-fiber-glass-reinforced materials. Transfer molding these compounds through conventional sprues and gates with 10- to 30-mil openings results in such excessive breaking-up of the fibers that the strength advantage of the material is largely lost (a 12.0-ft./lb. compound, for instance, will drop to 1.0 ft./lb. or less after passing through such gating). Transfer molding through large gates (¼ to ½ in. in diameter), which does not degrade the glass, will, on the other hand, result in concentric circular cracks around the gate opening which are prohibitively unattractive in appearance for most applications. An example of this is shown in the mounting blocks illustrated in Fig. 25, p. 124.

The cause of these cracks can best be understood in terms of the earlier discussion of fiber orientation (see Part I, "Strength vs. Flow"). Note that the last material to enter the mold in either Fig. 10A or 10B of Part I is bound to flow out radially from the gate opening as the last voids in the mold are squeezed out by the pressure of the inflowing material. This expanding radial flow of compound will produce a natural circular orientation of the fibers around the gate opening.

The only answers to this problem today leave a great deal to be desired. Short fiber, low-impact compounds can be made to work reasonably well; or very large sprues and gates can sometimes be utilized successfully.

Gradually the cracking problems on these materials are yielding to improved knowledge of their behavior and the compounding and molding factors which must be controlled to avoid them.

Next installment: Inserts, thin wall problems, and scaling.

Vinyl plasticizer

(From pp. 133-150)

types are the acrylonitrile or fumaronitrile adduct of butyl eleostearate (194), ester of maleic anhydride-oleonitrile condensate (222), and β-cyanoethyl alkylmalonic esters (140).

Some ester amines of possible plasticizer value are esters of N-phenyldiethanolamine (17, 18, 20), triethanolamine (17, 19, 20), and $HOOCC_6H_4N(CH_3)CH_2COOH$ (119). Some related esters containing additional sulfur groups are derived from mercaptobenzothiazole (84, 96, 100). The amino group is usually tertiary. Esters of iminobis (acetic acid) are an exception (147).

Miscellaneous types: Other plasticizer types suggested for PVC are tetracresyl silicate for good electrical resistance (376), other orthosilicates (220), dinitronaphthalene (361), acetals (306), polychlorophenyl alkyl ethers (285, 370), glycol bisether of C_4-C_{10} alcohols (318), nitrophenyl 2-ethoxyethyl ether (430), naphthoyl undecane (56), ethers of α-methylbenzyl alcohol (128), and thioacetals such as $C_3H_7CH(SCH_2C_6H_5)_2$ (192).

No plasticizer: Flexible copolymers of high vinyl chloride content can be made that require little if any plasticizer for flexibility. Examples are vinyl chloride-dilauryl maleate-vinyl stearate (43), vinyl chloride-vinyl acetate-2-ethylhexyl acrylate (419), and vinyl chloride-acrylonitrile-octyl acrylate (420) terpolymers. Nor is plasticizer required by vinyl chloride-isononyl acrylate copolymer (0.01% diallyl maleate also used) (418). There are many obvious advantages to dispensing with plasticizer but progress in this direction does not appear to be rapid.

References

1. O. Ackelsberg, U. S. Pat. 2.778,849 (1957).
2. D. Aelony, Ind. Eng. Chem. *46*, 587 (1954).
3. R. R. Aitken, D. H. Coffey, and E. A. Packer, Br. Pat. 744,831 (1956).
4. G. Akazome, J. Japan Oil Chemists Soc. *4*, 250 (1955).
5. V. I. Alekseenko, and I. U. Mishustin, Kolloid Zhur. *18*, 257 (1956); Chem. Abstr. *51*, 1648 (1957).
6. Anon., Chem. Eng. News *35*, 80 (7-1-57).
7. —, Chem. Week, p. 42 (Jan. 14, 1956).
8. —, p. 84 (Apr. 7, 1956).
9. —, p. 84 (July 7, 1956).
10. —, Elec. Engrg., p. 1018 (Nov. 1954).

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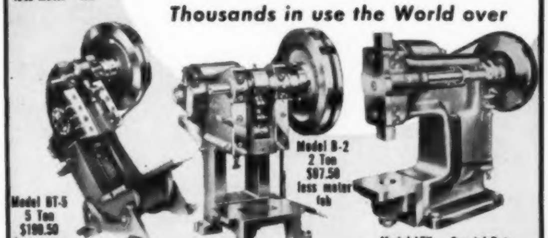

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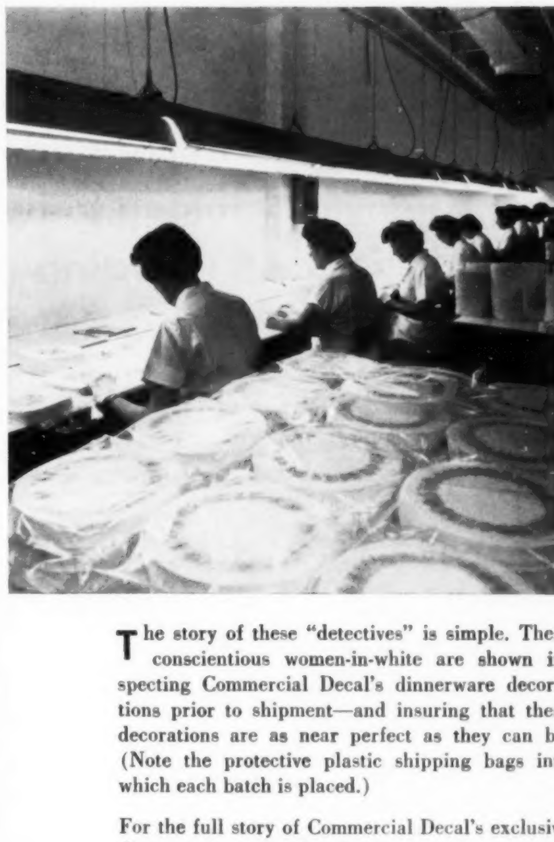

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COMMERCIAL DECAL

11. —, Modern Plastics 29, 186 (Aug. 1952).
12. —, 29, 190 (Aug. 1952).
13. —, 30, 206 (Oct. 1952).
14. —, 30, 100 (Aug. 1953).
15. —, Oil Paint and Drug. Rep. p. 71 (Nov. 8, 1954).
16. —, Selected Govt. Research Repts. (Gt. Brit.), Vol. 1, Plastics Report No. 3, p. 93 (1952); Chem. Abstr. 47, 3027 (1953).
17. Y. Arai, T. Masuzawa, and R. Oda, J. Chem. Soc. Japan, Ind. Chem. Sec. 57, 517 (1954); Chem. Abstr. 49, 5022 (1955).
18. —, 58, 57 (1955); Chem. Abstr. 49, 13891 (1955).
19. Y. Arai, and R. J. Oda, J. Chem. Soc. Japan, Ind. Chem. Sec. 57, 402 (1954); Chem. Abstr. 49, 4323 (1955).
20. Y. Arai, and S. Watanabe, Japan Pat. 2990 (1956); Chem. Abstr. 51, 10126 (1957).
21. G. W. Ashworth, J. R. Darby, W. E. Koerner, and R. H. Munch, A.S.T.M. Bull. No. 222, 38 (May 1957).
22. W. C. Ault, and R. O. Feuge, Br. Pat. 775,326 (1957).
23. W. L. Baears, U. S. Pat. 2,650,908 (1953).
24. M. Baer, U. S. Pat. 2,750,351 (1956).
25. Union Carbide Plastics Co., New York, Tech. Release No. 14, Bakelite Vinyl Dispersion Resin QYNV, (1954).
26. E. J. G. Bailey and W. Walker, U.S. Pat. 2,730,513 (1956).
27. C. E. Balmer and R. F. Conyne, Rubber Age 79, 105 (1956).
28. F. W. Banes, D. W. Young, and A. J. Hund, U.S. Pat. 2,636,866 (1953).
29. G. Beck, Kunststoffe 45, 230 (1955).
30. H. S. Bergen, E. E. Cowell, and W. Waychoff, Modern Plastics 31, 93 (Nov. 1953).
31. S. Berk, A.S.T.M. Bull. No. 168, 53 (Sept. 1950).
32. S. Berk, H. Ebert, and L. Teitell, Ind. Eng. Chem. 49, 1115 (1957).
33. E. S. Blake, U.S. Pat. 2,692,207 (1954).
34. M. Bomar, Chem. Abstr. 51, 14318 (1957).
35. R. F. Boyer, J. Applied Physics 22, 723 (1951).
36. Br. Pat. 586,826 (1947).
37. Br. Pat. 688,344 (1953).
38. Br. Pat. 709,226 (1954).
39. Br. Pat. 713,355 (1954).
40. Br. Pat. 741,492 (1955).
41. Br. Pat. 754,880 (1956).
42. Br. Pat. 777,780 (1957).
43. Br. Pat. 779,854 (1957).
44. Br. Pat. 783,300 (1957).
45. Br. Pat. 786,557 (1957).
46. J. D. Brandner and R. H. Hunter, U.S. Pat. 2,711,999 (1955).
47. R. M. Brice and W. M. Budde, Ind. Eng. Chem. 50, 869 (1958).
48. P. F. Bruins and E. J. Kurtz, U.S. Pat. 2,585,222 (1952).
49. P. F. Bruins, E. P. Wilkinson, and E. P. Rittershausen, U.S. Pat. 2,642,407 (1953).
50. W. M. Bruner, Ind. Eng. Chem. 41, 2860 (1949).
51. K. Buchner, U.S. Pat. 2,780,643 (1957).
52. S. L. Burt, U.S. Pat. 2,618,621 (1952).
53. J. M. Butler, U.S. Pat. 2,687,421 (1954).
54. J. R. Caldwell, U.S. Pat. 2,728,738 (1955).
55. E. Chadwick, Br. Plastics 29, 342 (1956).
56. T. Chikamori and T. Sakashita, J. Soc. Rubber Ind. Japan 26, 87 (1953); Chem. Abstr. 49, 3575 (1955).
57. G. Chizallet, Fr. Pat. 1,039,518 (1953).
58. A. W. M. Coaker and M. W. Williams, Modern Plastics 33, 160 (Oct. 1955).
59. B. Coe, Rubber Age 72, 220 (1952).
60. S. J. Cohen, U.S. Pat. 2,500,893 (1950).
61. R. F. Conyne and E. A. Yehle, Ind. Eng. Chem. 47, 853 (1955).
62. E. E. Cowell, U.S. Pat. 2,671,769 (1954).
63. E. E. Cowell and J. R. Darby, U.S. Pat. 2,568,989 (1951).
64. P. C. Daidone, Modern Plastics 32, 159 (Apr. 1955).
65. M. L. Dannis, Phys. Rev. 89, 341 (1953).
66. F. Danusso, G. Iutzu, and D. Sianesi, Chem. Abstr. 50, 6832 (1956).
67. M. J. Danzig, J. L. O'Donnell, E. W. Bell, J. C. Cowan, and H. M. Teeter, J. Am. Oil Chem. Soc. 34, 136 (1957).
68. J. R. Darby, and P. R. Graham, Modern Plastics 32, 148 (June 1955).
69. A. Dawant and K. Elias, Fr. Pat. 1,011,689 (1952).
70. J. Dazzi, U.S. Pat. 2,563,312 (1951).
71. —, 2,563,313 (1951).
72. —, 2,569,404 (1951).
73. —, 2,569,405 (1951).
74. —, 2,569,406 (1951).

75. —, 2,569,407 (1951).
76. —, 2,581,005-6 (1952).
77. —, 2,598,636 (1952).
78. —, 2,603,615 (1952).
79. —, 2,603,619 (1952).
80. —, 2,617,819 (1952).
81. —, 2,630,418 (1953).
82. —, 2,630,441 (1953).
83. —, 2,634,248 (1953).
84. —, 2,647,877 (1953).
85. —, 2,653,948 (1953).
86. —, 2,658,047 (1953).
87. —, 2,661,367 (1953).
88. —, 2,667,504 (1954).
89. J. Dazzi, and J. R. Darby, U.S. Pat. 2,683,701 (1954).
90. J. Dazzi, U.S. Pat. 2,687,389 (1954).
91. —, 2,687,390 (1954).
92. —, 2,687,428 (1954).
93. —, 2,687,429 (1954).
94. —, 2,695,280 (1954).
95. —, 2,709,691 (1955).
96. —, 2,725,364 (1955).
97. —, 2,745,846 (1956).
98. —, 2,757,151 (1956).
99. —, 2,757,180 (1956).
100. —, 2,762,786 (1956).
101. —, 2,769,834 (1956).
102. —, 2,782,217 (1957).
103. —, 2,786,039 (1957).
104. —, 2,802,016 (1957).
105. —, 2,806,011 (1957).
106. —, 2,809,947 (1957).
107. J. Dazzi, and J. R. Darby, U.S. Pat. 2,683,701 (1954).
108. J. M. DeBell and M. H. Nickerson, U.S. Pat. 2,715,615 (1955).
109. J. B. DeCoste and V. T. Wallder, Ind. Eng. Chem. *47*, 314 (1955).
110. W. A. Denison and W. N. Stoops, U.S. Pat. 2,657,188 (1953).
111. M. H. Dilke, D. Faulkner, and S. Merry, U.S. Pat. 2,755,259 (1956).
112. —, 2,755,262 (1956).
113. R. E. Dillon, E. B. Bradford, and R. D. Andrews, Ind. Eng. Chem. *45*, 728 (1953).
114. D. Druesedow and C. F. Gibbs, Modern Plastics *30*, 123 (June 1953).
115. B. W. Duke and M. T. Gladstone, Modern Plastics *30* 126 (Aug. 1953).
116. J. H. Dunn and P. E. Weimer, U.S. Pat. 2,773,046 (1956).
117. Eastman Chemical Products, Inc., Kingsport, Tenn., Technical Data Report 101 (1956).
118. W. E. Elwell and J. C. Butler, U.S. Pat. 2,823,192 (1958).
119. W. S. Emerson and R. A. Heimsch, U.S. Pat. 2,687,391 (1954).
120. —, 2,730,512 (1956).
121. W. S. Emerson and R. I. Longley, U.S. Pat. 2,581,008 (1952).
122. —, 2,585,448 (1952).
123. —, 2,637,714 (1953).
124. —, 2,700,656 (1955).
125. —, 2,766,266 (1956).
126. Enjay Co., Plasticizers from Enjay Alcohols, (1954).
127. D. Faulkner, U.S. Pat. 2,553,308 (1951).
128. D. Faulkner, H. M. Stanley, and J. J. P. Staudinger, U.S. Pat. 2,575,444 (1951).
129. D. Faulkner and G. T. Wright, Proc. XIth Intern. Congr. Pure and Appl. Chem. (London) *5*, 545 (1947) (Publ. 1953).
130. E. W. M. Fawcett and A. Millien, U.S. Pat. 2,580,290 (1951).
131. M. L. Fein, and C. H. Fisher, U.S. Pat. 2,631,988 (1953).
132. M. L. Fein, E. H. Harris, T. J. Dietz, and E. M. Filachione, India Rubber World *126*, 783 (1952).
133. R. I. Fel'dman and A. K. Miranova, Chem. Abstr. *50*, 4552 (1956).
134. W. E. Field, U.S. Pat. 2,567,905 (1951).
135. E. M. Filachione, M. L. Fein, and C. H. Fisher, U.S. Pat. 2,584,998 (1952).
136. C. K. Fink, and K. L. Brown, U.S. Pat. 2,819,235 (1958).
137. W. F. Fischer, and B. M. Vanderbilt, Modern Plastics *33*, 164 (May 1956).
138. G. S. Fisher, L. A. Goldblatt, and J. S. Stinson, U.S. Pat. 2,750,411 (1956).
139. W. P. Fitzgerald and P. V. Smith, U.S. Pat. 2,842,513 (1958).
140. D. E. Floyd, Can. Pat. 506,794 (1954).
141. R. Forquet, Materie Plastiche *21*, 371 (1955); Chem. Abstr. *49*, 13689 (1955).
142. J. L. Foster, Materials and Methods *28*, No. 9, 81 (1948).
143. Fr. Pat. 978,153 (1951).
144. Fr. Pat. 989,648 (1951).
145. Fr. Pat. 992,707 (1951).
146. Fr. Pat. 993,030 (1951).
147. Fr. Pat. 1,007,084 (1952).
148. H. E. Frey, Kunststoffe *46*, 81 (1956).
149. —, Modern Plastics 35, 164 (Dec. 1957).
150. W. J. Frissell, Ind. Eng. Chem. *48*, 1096 (1956).
151. M. Fujii and Y. Ohtsuka, Chem. High Polymers (Japan) *12*, 93 (1955); Chem. Abstr. *51* 1647 (1957).
152. M. F. Fuller, Ind. Eng. Chem. *49*, 730 (1957).
153. H. C. Funk and M. B. Reger, U.S. Pat. 2,690,981 (1954).
154. B. L. Funt and T. H. Sutherland, Canadian J. Chem. *33*, 1669 (1955).
155. H. R. Gamrath, Can. Pat. 524,575 (1956).
156. H. R. Gamrath and R. E. Hatton, U.S. Pat. 2,694,689 (1954).
157. H. R. Gamrath, R. E. Hatton, and W. E. Weesner, Ind. Eng. Chem. *46*, 208 (1954).
158. H. R. Gamrath and W. E. Weesner, U. S. Pat. 2,588,512 (1952).
159. T. Gast, K. H. Hellwege, and Kohlhepp, Kolloid Z. *152*, 24 (1957).
160. J. R. Geenty, India Rubber World *126*, 646 (1952).
161. R. H. Gillespie, U.S. Pat. 2,646,414 (1953).
162. A. Gislon, U.S. Pat. 2,615,859 (1952).
163. E. W. Gluesenkamp, U.S. Pat. 2,617,778 (1952).
164. E. W. Gluesenkamp, and J. Dazzi, U.S. Pat. 2,610,164 (1952).
165. —, U.S. Pat. 2,610,165 (1952).
166. B. F. Goodrich Chemical Co., Hycar Technical Newsletter, Vol. 3, No. 7 (1954).
167. K. Goto, Chem. High Polymers (Japan) *8*, 262, 268 (1951); Chem. Abstr. *47*, 1424 (1953).
168. —, *9*, 411 (1952); Chem. Abstr. *48*, 7928 (1954).
169. C. E. Greene, U.S. Pat. 2,654,723 (1953).
170. M. S. Greenhalgh and S. C. Martens, U.S. Pat. 2,708,173 (1955).
171. F. P. Greenspan and R. J. Gall, Ind. Eng. Chem. *45*, 2722 (1953).
172. —, Ind. Eng. Chem. *50*, 865 (1958).
173. —, J. Am. Oil Chem. Soc. *33*, 391 (1956).
174. R. K. Griffith and H. C. Nelson, U.S. Pat. 2,617,779 (1952).
175. O. J. Grummitt and R. E. Blank, U.S. Pat. 2,618,622 (1952).
176. W. Gundel and H. Damm, U.S. Pat. 2,684,917 (1954).
177. G. Guzzetta, Chem. Abstr. *50*, 9057 (1956).
178. Y. Hachihama and I. Hayashi, Chem. Abstr. *48*, 3717 (1954).
179. D. E. Hardman, U.S. Pat. 2,806,828 (1957).
180. A. Hartman, Kolloid Z. *142*, 123 (1955).
181. —, *148*, 30 (1956).
182. C. B. Havens, U.S. Pat. 2,604,458 (1952).
183. —, Can. Pat. 524,219 (1956).
184. I. Hayashi and Y. J. Hachihama, Chem. Soc. Japan, Ind. Chem. Sec. *57*, 504 (1954).
185. I. Hayashi, S. Hamada, and Y. Hachihama, Chem. Abstr. *49*, 8822 (1955).
186. J. H. Helberger and H. Fuchs, Ger. Pat. 878,276 (1953).
187. Henderson, U.S. Pat. 2,330,353 (1942).
188. E. J. Hensch and A. G. Wilbur, Ind. Eng. Chem. *50*, 871 (1958).
189. S. J. Hetzel, U.S. Pat. 2,757,157 (1956).
190. A. Hill, Plastics (London) *22*, 103 (Mar. 1957).
191. F. Hoelscher, U.S. Pat. 2,807,598 (1957).
192. G. Hoffmann, H. Weber, and P. Kranzlein, Ger. Pat. 834,288 (1952).
193. J. S. Hoffman, R. T. O'Connor, F. C. Magne, and W. G. Bickford, J. Am. Oil Chem. Soc. *32*, 533 (1955).
194. —, *33*, 410 (1956).
195. H. Hoog, A. I. M. Keulemans, and A. Kwantes, Dutch Pat. 82,261 (1956).
196. W. B. Horback, F. Berardinelli, and W. D. Paist, U.S. Pat. 2,668,119; 2,668,174 (1954).
197. Y. Ishii, and S. Takazawa, J. Chem. Soc. Japan, Ind. Chem. Sec. *56*, 945 (1953); Chem. Abstr. *49*, 6904 (1955).
198. Y. Ishii, Y. Yamashita, and M. Takenouchi, Chem. Abstr. *52*, 10637 (1958).
199. Y. Ishii, Y. Yamashita, M. Takenouchi, and S. Takasawa, J. Chem. Soc. Japan, Ind. Chem. Sec. *57*, 667 (1954); Chem. Abstr. *49*, 8631 (1955).
200. G. Iutzu, Chem. Abstr. *50*, 6832 (1956).
201. R. W. James and D. W. Lovering, U.S. Pat. 2,636,871-2 (1953).
202. F. Johnston, U.S. Pat. 2,668,800 (1954).
203. H. Jones, and A. J. Hill, Oil and Colour Chem. Assoc. *35*, 485 (1952).
204. H. Joy, U.S. Pat. 2,760,972 (1956).
205. R. G. Kadesch, Modern Plastics *29*, 111 (Aug. 1952).
206. S. Kahn and W. B. Pings, U.S. Pat. 2,695,279 (1954).
207. D. X. Klein and M. N. Curgan, U.S. Pat. 2,657,186 (1953).

(To page 226)

208. G. R. Kloos, Kunststoffe *44*, 429 (1954).
209. —, Plastica 7, 232 (1954); Chem. Abstr. *48*, 14289 (1954).
210. W. Knappe, Z. angew. Phys. 6, 97 (1954).
211. W. Knappe and A. Schulz, Kunststoffe *41*, 321 (1951).
212. H. B. Knight, U.S. Pat. 2,613,157 (1952).
213. W. S. Knowles, U.S. Pat. 2,689,862 (1954).
214. W. S. Knowles and J. Dazzi, U.S. Pat. 2,683,161 (1954).
215. —, 2,684,955 (1954).
216. C. J. Knuth, U.S. Pat. 2,811,496 (1957).
217. C. J. Knuth and P. F. Bruins, Ind. Eng. Chem. 47, 1572 (1955).
218. R. Kobayashi and K. Mizutani, Japan Pat. 5792 (1955).
219. A. Koebner, Br. Pat. 790,314 (1958).
220. K. Kojima, N. Tamura, and M. Honda, Chem. Abstr. *50*, 1361 (1956).
221. E. C. H. Kolvoort, U.S. Pat. 2,575,-553 (1952).
222. Komori, et. al., J. Chem. Soc. Japan, Ind. Chem. Sec. *56*, 885 (1953).
223. S. Komori, Japan Pat. 4933 (1956).
224. S. Komori, E. Shinsugi, and Y. Nishimuri, J. Chem. Soc. Japan, Ind. Chem. Sec. 57, 740 (1954).
225. J. E. Koroly and E. M. Beavers, Ind. Eng. Chem. 45, 1060 (1953).
226. A. Kratochvil and J. Spirit, Chem. Abstr. 52, 14214 (1958).
227. Y. Kubouchi, H. Ashikawa, and J. Nakajima, Chem. High Polymers (Japan) 9, 215 (1952); Chem. Abstr. *48*, 1726 (1954).
228. R. C. Kuder, U.S. Pat. 2,754,281 (1956).
229. A. J. Lehman, Quart. Bull. Assoc. Food and Drug Officials of the U.S. *XV*, No. 3, 82 (July 1951).
230. —, *XVIII*, No. 4, 129 (Oct. 1954).
231. —, *XX*, No. 4, 159 (Oct. 1956).
232. A. J. Lehman and W. I. Patterson, Modern Packaging, p. 115 (Jan. 1955).
233. S. L. Lel'chuk and V. I. Sedlis, Chem. Abstr. *51*, 12539 (1957).
234. —, *51*, 18689 (1957).
235. —, 52, 15121 (1958).
236. F. Leonard, A. J. Szlachtun, and I. Cort, J. Poly. Sci. *11*, 539 (1953).
237. O. Leuchs, Kunststoffe *41*, 309 (1951).
238. O. Leuchs, Kunststoffe *46*, 547 (1956).
239. J. L. Lewis and C. F. Macy, U.S. Pat. 2,788,333 (1957).
240. P. H. Lipke and R. S. Montgomery, U.S. Pat. 2,752,319 (1956).
241. V. M. Loeblich, F. C. Magne, and R. R. Mod, Ind. Eng. Chem. 47, 855 (1955).
242. R. I. Longley, U.S. Pat. 2,727,013 (1955).
243. J. L. Ludlow, U.S. Pat. 2,749,329 (1956).
244. K. Lufsky and M. Zopfel, Chem. Abstr. 52, 2449 (1958).
245. H. Luther and G. Weisel, Kolloid Z. *154*, 15 (1957).
246. G. P. Mack, Modern Plastics, *31*, 150 (Nov. 1953).
247. F. C. Magne and R. R. Mod, Ind. Eng. Chem. 45, 1546 (1953).
248. —, J. Am. Oil Chem. Soc. *30*, 269 (1953).
249. F. C. Magne, R. R. Mod, and E. L. Skau, Ind. Eng. Chem. *50*, 617 (1958).
250. —, J. Am. Oil Chem. Soc. 35, 477 (1958).
251. F. S. Mallette and E. Von Haam, A.M.A. Arch. Indust. Hyg. and Occup. Med. *6*, 231 (Sept. 1952).
252. G. C. Martin and A. J. Sears, U.S. Pat. 2,627,482 (1953).
253. R. W. Martin, U.S. Pat. 2,598,406 (1952).
254. S. Matsuda, Japan Pat. 43 (1957).
255. M. Mention and P. Bourguignon, Ger. Pat. Appl. U2109 (1956).
256. —, U.S. Pat. 2,776,984 (1957).
257. T. H. G. Michael and F. J. McQuaig, Chem. and Eng. Data Ser. *1*, No. 1, 118 (1956).
258. T. F. Mika and R. D. Sullivan, U.S. Pat. 2,764,497 (1956).
259. Y. Minematsu, Chem. Abstr. *48*, 9742 (1954).
260. R. S. Montgomery, U.S. Pat. 2,764,-571 (1956).
261. C. E. Morrell, U.S. Pat. 2,781,396 (1957).
262. T. Motoyanagi, Y. Yamashita, and Y. Ishii, J. Chem. Soc. Japan, Ind. Chem. Sec. *56*, 887 (1953); Chem. Abstr. *49*, 6904 (1955).
263. K. Murai and G. Akazome, J. Japan Oil Chem. Soc. *4*, 125 (1955).
264. K. Murai, G. Akazome, S. Ito, and N. Tsujisaka, J. Japan Oil Chem. Soc. *3*, 2 (1954).

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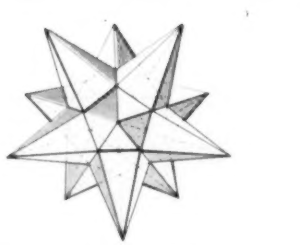

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265. K. Murai, G. Akazome, N. Tsujisaka, and M. Sakurai, J. Japan Oil Chem. Soc. *3*, 200 (1954).
266. K. Murakami, Chem. High Polymers (Japan) *7*, 376 (1950); Chem. Abstr. *46*, 6425 (1952).
267. L. A. McKenna, Modern Plastics *35*, 142 (June 1958).
268. O. Nehring, Chem. Abstr. *51*, 15990 (1957).
269. R. C. Newberg, O. C. Slotterbeck, and B. M. Vanderbilt, U.S. Pat. 2,552,904 (1951).
270. H. A. Newey, U.S. Pat. 2,795,565 (1957).
271. L. W. Newton, U.S. Pat. 2,603,616 (1952).
272. W. D. Niederhauser and J. E. Koroly, U.S. Pat. 2,485,160 (1949).
273. L. E. Nielsen, R. Buchdahl, and R. Levreault, J. Appl. Phys. *21*, 607 (1950).
274. M. Nishide and N. Onodera, Japan Pat. 8041 and 8042 (1954); Chem. Abstr. *50*, 8249 (1956).
275. E. Nobis, Kunststoffe *47*, 180 (1957).
276. S. Ouchi, S. Shoji, and S. Yasuhira. Chem. Abstr. *48*, 6733 (1954).
277. T. M. Patrick, U.S. Pat. 2,594,488 (1952).
278. T. C. Patton, India Rubber World *129*, 371 (1952).
279. T. C. Patton and F. M. Hall, Plastics Tech. *2*, 22 (1956).
280. —, U.S. Pat. 2,794,791 (1957).
281. T. C. Patton and L. J. Lubanowsky, U.S. Pat. 2,580,460 (1952).
282. K. Parker and L. Tritsch, Modern Plastics *30*, 129 (Feb. 1953).
283. A. H. Passedouet, U.S. Pat. 2,820,-771 (1958).
284. G. B. Pavne and C. W. Smith, U.S. Pat. 2,761,870 (1956).
285. O. Pesta and F. Sinwel, Kunststoffe *46*, 155 (1956).
286. J. C. Petropoulos, U.S. Pat. 2,780,-609 (1957).
287. I. Phillips and P. G. Youde, Br. Plastics *29*, 337 (1956).
288. I. Pockel, U.S. Pat. 2,611,756 (1952).
289. M. W. Pollock, U.S. Pat. 2,789,957 (1957).
290. R. W. Pooley, U.S. Pat. 2,757,147 (1956).
291. W. S. Port, et. al., Ind. Eng. Chem. *47*, 472 (1955).
292. G. M. Powell, et. al., Modern Plastics *28*, 129 (June 1951).
293. F. J. Prescott and G. O. Gragwell, Modern Plastics *30*, 134 (Oct. 1952).
294. H. M. Quackenbos, Ind. Eng. Chem. *46*, 1335 (1954).
295. R. W. Quarles, E. T. Severs, A. C. Frechtling, and H. S. Carpenter, Modern Plastics *28*, 99 (Jan. 1952).
296. A. W. Ralston and L. T. Crews, U.S. Pat. 2,552,814 (1951).
297. M. C. Reed, H. F. Klemm, and E. F. Schulz, Ind. Eng. Chem. *46*, 1344 (1954).
298. C. E. Rehberg, U.S. Pat. 2,676,941 (1954).
299. C. E. Rehberg, T. J. Dietz, P. E. Meiss, and M. B. Dixon, Ind. Eng. Chem. *44*, 2191 (1952).
300. C. E. Rehberg and C. H. Fisher, U.S. Pat. 2,712,025 (1955).
301. C. E. Rehberg and J. Siciliano, Ind. Eng. Chem. *44*, 2864 (1952).
302. R. Reichherzer, Chem. Abstr. *49*, 8630 (1955).
303. R. Reichherzer, Chem. Abstr. *51*, 15171 (1957).
304. R. J. Reid and W. M. Smith, U.S. Pat. 2,666,039 (1954).
305. R. J. Reid, W. M. Smith, and B. H. Werner, U.S. Pat. 2,802,802 (1957).
306. R. J. Reid and B. H. Werner, U.S. Pat. 2,802,804 (1957).
307. R. A. Reznikova, S. S. Voyutskii, and A. D. Zaionchkovskii, Kolloid Zhur. *16*, 204 (1954); Chem. Abstr. *48*, 11834 (1954).
308. R. A. Reznikova, A. D. Zaionchkovskii, and S. S. Voyutskii, Kolloid Zhur. *15*, 108 (1953); Chem. Abstr. *47*, 7816 (1953).
309. E. K. Rideal, Selected Govt. Research Reports, Vol. 1, Plastics Report No. 2, 45 (1952); Chem. Abstr. *50*, 1359 (1956).
310. W. L. Riedeman, U.S. Pat. 2,755,264 (1956).
311. —, 2,755,265 (1956).
312. E. F. Riener, U.S. Pat. 2,756,242 (1956).
313. W. Riese, Kunststoffe *47*, 116 (1957).
314. A. W. Ritter and S. P. Rowland, U.S. Pat. 2,771,472 (1956).
315. E. J. Roberts, L. F. Martin, F. C. Magne, and R. R. Mod, Rubber World *130*, 801 (1954).
316. S. B. Robison and J. Rehner, U.S. Pat. 2,632,021 (1953).

(To page 231)

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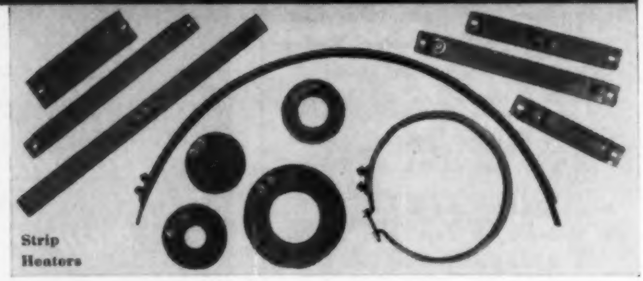

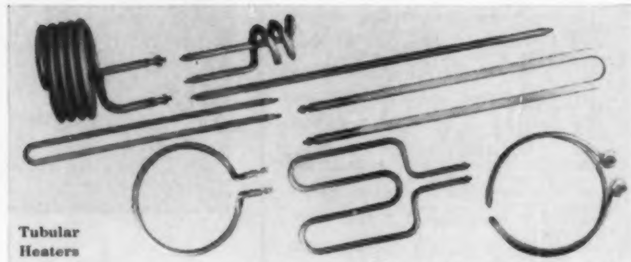

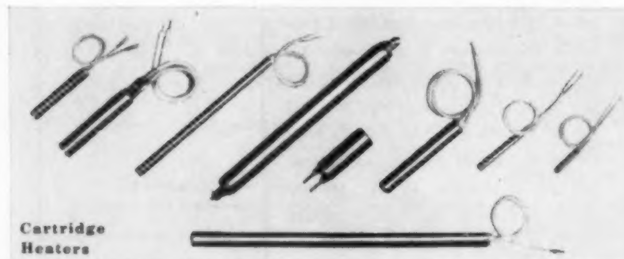

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317. P. Robitschek and D. B. Storman, U.S. Pat. 2,731,431 (1956).
318. Ross, U.S. Pat. 2,668,801 (1954).
319. L. Rossig, Kunststoffe *44*, 250 (1954).
320. —, *48*, 41 (1958).
321. S. P. Rowland and R. F. Conyne, U.S. Pat. 2,822,368 (1958).
322. D. Rysavy, Chem. Abstr. *52*, 4236 (1958).
323. Stafford, U.S. Pat. 2,539,207 (1951).
324. H. Sakurai and S. Wakano, Chem. Abstr. *51*, 9207 (1957).
325. I. O. Salyer and J. A. Herbig, U.S. Pat. 2,733,228 (1956).
326. G. S. Schaffel and G. H. Swart, U.S. Pat. 2,656,333 (1953).
327. Scheer, U.S. Pat. 2,565,888 (1951).
328. O. v. Schickh and W. Froese, U.S. Pat. 2,648,652 (1953).
329. E. F. Schulz, A.S.T.M. Bull. No. *183*, 75 (July 1952).
330. E. F. Schulz, Modern Plastics *29*, 120 (Aug. 1952).
331. E. H. Schwenke, U.S. Pat. 2,654,719 (1953).
332. E. H. Schwenke, U.S. Pat. 2,779,743 (1957).
333. V. I. Sedlis and S. L. Lel'chuk, Chem. Abstr. *52*, 7761 (1958).
334. E. T. Severs and J. M. Austin, Ind. Eng. Chem. *46*, 2369 (1954).
335. E. T. Severs and A. C. Frechtling, U.S. Pat. 2,753,314 (1956).
336. Severs and Smitmans. Paint Varnish Production *47*, No. 12, 54 (1957).
337. C. B. Shaffer, C. P. Carpenter, and H. F. Smyth, J. Indust. Hyg. and Tox. *27*, No. 5 (May 1945).
338. Shigeno, Karaki, Komori, and Takazawa, Chem. Abstr. *52*, 13310 (1958).
339. Y. Shigeno and S. Komori, Chem. Abstr. *51*, 8453 (1957).
340. —, *51*, 9208 (1957).
341. Y. Shigeno, S. Komori, and K. Kataoka, J. Chem. Soc. Japan, Ind. Chem. Sec. *55*, 739 (1952); Chem. Abstr. *48*, 7917 (1954).
342. Y. Shigeno, et. al., J. Chem. Soc. Japan, Ind. Chem. Sec. *59*, 63, 186, 191, 913, 919 (1956).
343. —, Chem. Abstr. *52*, 8614 (1958).
344. Y. Shigeno, S. Komori, and H. Yamamoto, J. Chem. Soc. Japan, Ind. Chem. Sec. *59*, 63 (1956).
345. Y. Shigeno, et. al., Chem. Abstr. *52*, 8613 (1958).
346. Shimomura, Takemota, and Masuzawa, Chem. Abstr. *50*, 6088 (1956).
347. S. Shoji, Chem. Abstr. *51*, 17223 (1957).
348. T. Shono and Y. Hachihama, J. Chem. Soc. Japan, Ind. Chem. Sec. *57*, 836 (1954); Chem. Abstr. *50*, 295 (1956).
349. R. J. Signer and K. F. Beal, U.S. Pat. 2,658,050 (1953).
350. R. M. Silverstein, C. W. Mosher, and L. M. Richards, J. Am. Oil Chem. Soc. *32*, 354 (1955).
351. C. C. Smith, A.M.A. Arch. Indust. Hyg. and Occup. Med. *7*, 310 (April 1953).
352. Smith, U.S. Pat. 2,691,663 (1954).
353. —, 2,744,877 (1956).
354. Smith, U.S. Pat. 2,624,714 (1953).
355. P. V. Smith and D. W. Young. U.S. Pat. 2,625,527 (1953).
356. —,2,734,884 (1956).
357. P. V. Smith, D. W. Young, and R. G. Newberg, U.S. Pat. 2,628,207 (1953).
358. Smith, U.S. Pat. 2,647,099 (1953).
359. W. M. Smith and R. J. Reid, U.S. Pat. 2,647,098 (1953).
360. Snyder, U.S. Pat. 2,779,748 (1957).
361. H. Sobue, K. Washimi, and M. Takahashi, Chem. Abstr. *52*, 10633 (1958).
362. S. I. Sokolov, S. A. Reitlinger, and Fel'dman, Kolloid Zhur. *19*, 624 (1957); Chem. Abstr. *52*, 2449 (1958).
363. C. A. Sprang and R. W. Webster, U.S. Pat. 2,820,802 (1958).
364. F. J. Sprules and H. C. Marks, U.S. Pat. 2,802,800 (1957).
365. W. H. Stahl and H. Pessen, J. Am. Chem. Soc. 74, 5487 (1952).
366. —, Modern Plastics *31*, 111 (July 1954).
367. H. A. Stansbury and H. R. Guest, U.S. Pat. 2,731,489 (1956).
368. T. R. Steadman and J. O. H. Peterson, Ind. Eng. Chem. *50*, 59 (1958).
369. H. Steiner, H. S. Boyd-Barrett, and J. R. Holker, Br. Pat. 641,832 (1950).
370. G. K. Storin, F. E. Lawlor, and F. Casciani, U.S. Pat. 2,814,602 (1957).
371. D. Swern, J. Am. Oil Chem. Soc. *31*, 574 (1954).
372. —, Paint and Varnish Production *46*, 29 (May 1956).
373. —, U.S. Pat. 2,624,680 (1953).
374. D. Swern and H. B. Knight, Br. Pat. 775,714 (1957).
375. D. Swern, W. E. Palm, B. Ackerman, and L. P. Witnauer, Ind. Eng. Chem. (in press)
376. T. Takatani, Japan Pat. 2349 (1956); Chem. Abstr. *51*, 7760 (1957).

(To page 232)

377. P. O. Tawney and R. H. Snyder, U.S. Pat. 2,755,271 (1956).
378. P. O. Tawney, R. H. Snyder, and R. W. Amidon, U.S. Pat. 2,719137 (1955).
379. D. E. Terry and D. H. Wheeler, U.S. Pat. 2,458,484 (1949).
380. —, 2,559,177 (1951).
381. K. Thinius, Chem. Tech. (Berlin) *4*, 471 (1952); Chem. Abstr. *47*, 11799 (1953).
382. —, *6*, 330 (1954); Chem. Abstr. *49*, 9959 (1955).
383. K. Thinius and E. Karutz, Deut. Farben-Z. *8*, 461 (1954); Chem. Abstr. *49*, 4323 (1955).
384. K. Thinius and W. Schwartz, Chem. Abstr. *51*, 12539 (1957).
385. W. D. Todd, SPE Journal *10*, 13 (March 1954).
386. Todd, Esarove, and Smith, Modern Plastics *34*, 159 (Sept. 1956).
387. Y. Toyama and S. Kaichi, J. Chem. Soc. Japan, Ind. Chem. Sec. *54*, 221 (1951); Chem. Abstr. *47*, 2535 (1953).
388. J. F. Treon, F. R. Deutra, and P. F. Cleveland, A.M.A. Arch. Indust. Hyg. and Occup. Med. *8*, 170 (Aug. 1953).
389. H. G. Trieschmann, W. Ender, L. Reuter, and W. Froese, U.S. Pat. 2,-711,997 (1955).
390. K. H. W. Tuerck, U.S. Pat. 2,699,-434 (1955).
391. Valko, U.S. Pat. 2,616,865 (1952).
392. R. Van Cleve and D. H. Mullins, Ind. Eng. Chem. *50*, 873 (1958).
393. F. J. F. Van der Plas and C. P. Van Dijk, Ger. Pat. 925,253 (1955).
394. R. G. Van Kerpel, Ind. chim. belge *17*, 9 (1952).
395. W. G. Vennells, Plastics Inst. Trans. *21*, No. 43, 18 (1953).
396. Voigt, Kunststoffe *42*, 395 (1952).
397. O. Von Schickh and W. Froese, U.S. Pat. 2,648,652 (1953).
398. V. A. Voskresenskii, Chem. Abstr. *52*, 16785 (1958).
399. Voyutskii, Zaionchkovskii, and Reznikova, Kolloid Zhur. *18*, 515 (1956); Chem. Abstr. *51*, 6210 (1957).
400. A. T. Walter, J. Polymer Sci. *13*, 207 (1954).
401. Wartman, Br. Pl. *28*, 32 (1955).
402. —, Ind. Eng. Chem. *47*, 1013 (1955).
403. —, MPL, *32*, 139 (Feb. 1955).
404. L. H. Wartman and W. J. Frissel, Plastics Tech. *2*, 583 (1956).
405. H. Watanabe, Japan Pat. 7238 (1955).
406. S. Watanabe and T. Kuwata, Japan Pat. 4345 (1955).
407. S. Watanabe and T. Masuzawa, Chem. Abstr. *49*, 2112 (1955).
408. W. E. Weesner, U.S. Pat. 2,607,-798-9 (1952).
409. Weiler, U.S. Pat. 2,811,498 (1957).
410. M. S. Welling, Plastics (London) *21*, 121, 161, 194 (1956).
411. H. Wells and I. Williamson, Br. Plastics *31*, 310 (1958).
412. Wheelock, U.S. Pat. 2,614,094 (1952).
413. R. R. Whetstone and D. E. Winkler, U.S. Pat. 2,585,884 (1952).
414. G. Wick and H. Konig, Kunststoffe *46*, 583 (1956).
415. J. M. Wilkinson and R. E. Field, U.S. Pat. 2,815,354 (1957).
416. Wilson and McCormick, Indust. Med. and Surgery *23*, 479 (1954).
417. Witnauer, Knight, Palm, Koos, Ault, and Swern, Ind. Eng. Chem. *47*, 2304 (1955).
418. Wolf, U.S. Pat. 2,608,549 (1952).
419. —, 2,636,024 (1953).
420. R. J. Wolf, and A. N. Nicolay, U.S. Pat. 2,608,552 (1952).
421. G. Wormald and W. F. Spengeman, Ind. Eng. Chem. *44*, 1104 (1952).
422. F. Wurstlin, Kolloid Z. *152*, 31 (1957).
423. F. Wurstlin and H. Klein, Kunststoffe *47*, 527 (1957).
424. —, Makromol. Chem. *16*, 1 (1955).
425. T. Yamanouchi, Chem. High Polymers (Japan) *9*, 55 (1952); Chem. Abstr. *48*, 400 (1954).
426. —, *9*, 60 (1952); Chem. Abstr. *48*, 400 (1954).
427. Y. Yamashita and Y. Ishii, Chem. High Polymers (Japan) *9*, 205, 210 (1952); Chem. Abstr. *48*, 1725 (1954).
428. —, J. Chem. Soc. Japan, Ind. Chem. Sec. *56*, 811 (1953); Chem. Abstr. *49*, 6904 (1955).
429. Yatsutani, et. al., Japan Pat. 3946 (1956); Chem. Abstr. *51*, 13465 (1957).
430. H. Yokoi and M. Imoto, Japan Pat. 5616 (1951); Chem. Abstr. 47, 3615 (1953).
431. H. Yokota, H. Murata, and M. Umemura, Chem. High Polymers (Japan) *8*, 227 (1951); Chem. Abstr. *47*, 1424 (1953).
432. M. Zief, A.I.C.-309, U.S. Dept. Agr. (1951).
433. K. Zohrer and A Merz, Kunststoffe *45*, 9 (1955).
434. F. J. Zukas, U.S. Pat. 2,773,043 (1956).—**End**

Report on the Pacific S.P.I. Conference

Over 650 visitors from all over the United States attended the 16th Annual Conference of the Pacific Coast Section of the S.P.I. held March 25-27 at San Diego, Calif.

The keynote of the Conference was sounded by John Delmonte, president of Furane Plastics, Inc., in an address entitled "Plastics Are Synergistic," that is that plastics, when combined with other materials, add beneficial property factors to a product.

There is a growing trend, he found, toward the wedding of plastics to other materials. In every instance of such combinations, the end product has properties unattainable by either material alone (see also MPL, March 1958, p. 41). "It is significant," he stated, "that the very nature of plastics is such that one seeks to combine them with other materials. This constant infusion into other industries is welcomed by all concerned because of the synergistic results."

Papers presented

Not only was the attendance impressive. The papers given were also of a high caliber. Fifteen of them were presented, covering the latest developments in materials, processing techniques, and applications.

MATERIALS: R. A. Buckley, Ferro Chemical Corp., addressed the meeting on **"Today's Approaches to Polyvinyl Chloride Stabilization."** He told the meeting that the growth of the vinyl industry and the resulting increase in the variety and complexity of formulations have made the matter of stabilization more important than ever. The choice of an optimum system must, therefore, be very carefully considered, with special attention to resin, plasticizer, filler, and pigments as they affect stability.

"Polypropylene Markets" was the subject discussed by R. D. Ullrich, Hercules Powder Co. The material, he stated, is showing real promise as a means of developing new business for the thermoplastics industry, especially as a replacement for glass, metals, thermosets, and natural materials. Several case histories of such switches were given.

Another new thermoplastic was introduced by C. R. Lindegren, Du Pont, in a paper entitled **"Delrin, Acetal Resin."** The material (described in MPL, Dec. 1957, p. 103) has outstanding tensile strength, rigidity, fatigue life, resistance to creep and solvents at room and elevated temperature, dimensional stability, and good electrical and frictional properties, according to Mr. Lindegren. It thus constitutes an outstanding new engineering material. Of particular significance is the fact that molded acetal affords the designer economies in replacing some types of aluminum and zinc die castings.

D. A. Jones, Celanese Corp. of America, in a paper titled **"Polyethylene Copolymers—Properties and Applications,"** outlined the effects of various densities and melt indexes on the processibility and properties of polyolefins. Extruded, blow molded, and injection molded applications were covered.

PROCESSING TECHNIQUES: The meeting was given a far-ranging survey of the newest processing equipment by Robert Moyer, Monsanto Chemical Co., in **"Recent Developments in Plastics Converting Equipment."** Valve control came in for discussion, as did "jet-flow" injection machines. New extruder designs were described which increase output by as much as 30% without reduction in quality. Other equipment covered included extruders with venting features; vacuum hoppers; and beta gages for analysis and control of extruder performance.

"Blow Molding Techniques" were outlined by Soren Graae, The Blow-O-Matic Corp. How important this process is soon going to be can be judged by some market estimates given by Mr. Graae: In three to five years, blow molded bottles will account for 50% of the U.S. bottle market and consume about 300 million lb. of material per year. (See also p. 107 of this issue.)

With special nozzle, impact molding can be made to pay even greater dividends by sequencing the operation of multiple nozzles. This was the conclusion drawn by Fred C. Means, Plastics Machine Div., Fellows Gear Shaper Co., in his paper **"Sequential Impact Molding."**

The importance of distinguishing between anisotropic and isotropic materials to molders and mold makers was pointed out in **"Molding of Anisotropic Plastics,"** a paper read by H. S. Malby, Celanese Corp. of America. Included in this group are the polyolefins. Examples showed the effects of products when plastic flow is not controlled during molding.

APPLICATIONS: Successful market development work can shorten the time for new markets to open; at the same time, by integrating production activities, long-range market predictions can be used to guide material production. These were the opinions expressed by T. W. Sharp, Union Carbide Plastics Co., in his paper **"Responsibilities of Raw Material Manufacturers in Market Development."** However, the work done by the materials suppliers must be supplemented by information from all converter levels.

Double glazing, with an outer shield of special glass and an inner structural member of laminated plastic was proposed as a sound attack on the problem of glazing for aircraft of today and tomorrow by C. Carpenter, Swedlow, Inc., in **"Approaches for Use of Plastic Glazing on High-Speed Aircraft."** The double glaze concept permits industry to combine the best properties of both glass and plastic into a composite design for optimum structural efficiency, lowest weight, and built-in cooling and defogging.

What happens to plastics on exposure to storable rocket propellents was summarized by R. C. Mowers, North American Aviation, in **"Effects of Storable Rocket Propellents on Plastic and Elastomeric Materials."** Most of the materials tested lose a portion of their initial properties.

Light-stabilized polystyrenes are finding increasing use in lighting fixture applications. P. H. Estes, Dow Chemical Co., in a paper on **"Polystyrene in Lighting Applications"** discussed polystyrene degradation and explained the wave length spectrum and how certain areas of this spectrum affect yellowing.

"Applications for Plastic Film and Plastic Film Laminations," by H. B. Pollack, Du Pont, reviewed the basic properties of Mylar with other plastic films currently available, and pointed out possible modifications through laminating, coating, and other methods.

In **"Building with Honeycomb Sandwich Construction,"** S. G. Saunders and A. C. Marshall, Hexcel Products, Inc., surveyed the advantages of such structures. The authors also found merit in cores made in structures other than honeycomb; at any rate they foresee a very bright future for structural sandwiches.

H. Dague, American Recording Tape Co., spoke on **"Magnetic Tapes for Sound and Video Systems and for Instrumentation."**

Organizational notes

During the business meeting, where the revised constitution and bylaws were accepted, the name of the section was changed to Western Section of S. P. I.

The Western Plastics Annual Award was made to Dr. Glen Havens, chairman of the board, Narmco, Inc., for his outstanding contributions to adhesive and structural plastics.

Newly elected officers of the Western Section, who will serve for one year starting June 1, 1959, are:

John M. Delmonte, Furane Plastics, Inc., chairman; J. H. Watt, Monsanto Chemical Co., vice-chairman; W. S. Rhodes, Mercury Plastics, Inc., secretary; J. Allen Carmien, New Plastic Corp., treasurer; and John L. Stief, Coast Mfg. & Supply Co., junior past chairman.—**End**

THE PLASTISCOPE*

News and interpretations of the news

By R. L. Van Boskirk

Section 2 *(Section 1 starts on p. 35)*

May 1959

Rexall changes name

Plans to change the name of the Rexall Drug Co. to Rexall Drug & Chemical Co. were recently announced in the company's annual report.

Pres. Justin Dart explained that in 1958 the company expanded its operations in the chemical field and that the Chemo-Plastics Div. now is an important factor in overall earnings and represents a significant portion of invested capital. (See MPL, March, 1959, p. 47).

It is anticipated that a major portion of the company's future growth will be in petrochemicals and allied chemical fields.

Rexall and its consolidated subsidiaries showed net earnings of over $6 million for 1958 as compared with over $4 million the previous year. Net sales for 1958 totaled over $182 million, a gain of more than $14 million over 1957. A 3% stock dividend was voted in addition to the regular dividends.

An interesting section of the company's annual report is an illustration showing hundreds of feet of Kraloy vinyl chloride pipe and Chemtrol fittings used in the Motion Picture Film Processing Laboratory, Patrick Air Force Base, Fla. Both Kraloy and Chemtrol are subsidiaries of Rexall. A brief description of this installation was published in MPL, April 1958, p. 58.

The report also states that the company's Seamco division which produces polystyrene will double its capacity in 1959 and expects to center attention on medium and high impact materials. Still another item of interest is the Seamless Rubber Div.'s development of Safe-T-Clad pipe wrap for protection of underground steel pipe and another subsidiary, United Cotton Products Co.'s production of industrial abrasive products for use in the metal fabricating industry.

G. E. discontinues custom molding

Sale of its plastics custom molding business by General Electric to Haveg Industries, Inc. of Wilmington, Del. has removed from the scene one of the earliest molders in the plastics business. The company entered the molding field when phenolics were a new material and when it was difficult to obtain molded parts that were suitable for its purposes. In selling to Haveg, G. E. has disposed of its custom business to a long established company that has specialized in the corrosion field and is now deeply involved in the missile program. Haveg will be competent to service G. E.'s former customers in molded plastics, fabricated silicone rubber, Mycalex high temperature insulating materials, sealing caps and sleeves. It will consolidate its new plastics business in the former G. E. plant in Taunton, Mass. The sale also included the business and much of the equipment in G. E.'s Decatur, Ill. plant, where the plastics operations will close about Sept. 1.

General Electric will now concentrate its attention in future growth in the materials area where it will merchandise silicone products, phenolic molding powders, polycarbonates, laminated products, and insulating materials.

Changes in personnel resulting from this realignment are as follows: E. M. Irish, Jr. has been appointed product manager for the phenolics line; A. J. Bzdula, former Detroit, Mich., sales representative, has been named field sales manager for the Chemical Materials Dept., succeeding Mr. Irish. W. F. Christopher has been appointed polycarbonate market development manager. E. J. Thomas, a technical service engineer in phenolic products since 1956, assumes the Detroit-Cleveland sales post.

Low-density polyethylene foam

A flexible, low density polyethylene foam has been placed on the market in limited quantities by The Dow Chemical Co.

The density is about 2 lb./cu. ft.—or 30 times lighter than water. Development engineers say that flotation, fabricated industrial parts such as gasketing, packaging, and thermal insulation, appear to be among major uses.

The foam may be adhered to itself by the use of heat alone. It may be adhered to other materials by the use of commercially available adhesives. Special techniques are necessary for coatings.

Production currently is at Dow's Midland, Mich. headquarters plant. The foam is available through Dow sales offices in 9 ft. lengths in two sizes of round stock, flattened ovals and untrimmed planks. The price is currently 22¢ per board foot.

Seminars on plastics

A special summer program on the mechanical and physical properties of plastics will be held at Massachusetts Institute of Technology from June 22 through June 26, 1959. Topics will include basic research as well as practical applications. Tuition fee is $175.00. For further information write: Prof. James M. Austin, Director of the Summer Session, M.I.T., Cambridge 39, Mass.

The Pennsylvania State University's Plastics Engineering Seminar, to be held from June 28 through July 3, 1959, is intended to keep design engineers and those engaged in research on materials abreast of the advances in the field of high polymers. To be discussed in the **(To page 238)**

* Reg. U.S. Pat. Off.

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seminar are chemistry, physics, and mechanical properties of high polymers; theory of viscoelasticity; design of plastics parts, and plastics under special service conditions. Tuition fee is $85.00. Additional information is available from the Extension Conference Center, The Pennsylvania State University, University Park, Pa.

Molds Delrin

A further indication of progress in the use of Du Pont's Delrin acetal resin is the expansion of facilities of Nylomatic Corp., Morrisville, Pa., to include molding of this new resin.

The company specializes in molding nylon with low-cost tooling, and will utilize the same process in the production of Delrin parts.

Moscow pavilion units tested

A new concept in plastics building components was revealed when five linked reinforced plastics units of a 70-part structure that will help shelter the American National Exhibition in Moscow this summer were wind-tested at Mitchell Field, N. Y., on March 27. Plans of the pavilion call for two structures, one built up from 45 of the flower-like units, the other composed of 25. Each unit arches gracefully upward from a single tapered polyester-glass column anchored to a concrete-and-steel foot planted just below ground level. At the top of the "stem," the "flower" has six doubly curved petals, spreading outward from the stem to form a hexagonal web. The outer edge of each web is pierced with bolt holes so that individual units may quickly be joined to form a single continuous roof. The joints are sealed with a soft calking compound and rain water drains down through the hollow cores of the columns.

The width of the web from edge to edge—equal to the center-to-center spacing of the columns because of the hexagonal symmetry—is just 15 ft., and the columns are about 20 ft. tall. The two finished structures, designed by George Nelson & Co., New York City, and engineered by Prof. Albert G. H. Dietz of MIT and the fabricators, Lunn Laminates, Inc., Huntington, N. Y., will shelter a 14,000-sq. ft. area at the Moscow Pavilion. The sides will be open. The cost of the structures is being underwritten by some two dozen leading plastics companies.

Since wind speeds occasionally reach 60 m.p.h. in Moscow, it was decided to test this unique new structure's ability to withstand such winds. While the designers felt confident that it could withstand even higher winds, our Canaveral-chastened State Department wanted to be absolutely sure there would be no unscheduled "launching" in Moscow this summer. So a five-unit test structure was erected at Mitchell Air Force Base, and twin-engine bombers were used to create winds gusting up to 60 m.p.h.

The five-unit umbrella—much less rigid than the larger units will be—whipped and twisted a little but survived with a perfect score.

FIVE-UNIT UMBRELLA of Moscow Pavilion (left), withstands 60-mile gale from bomber while engineers read manometer of pilot tube mounted at upper end of pole. Close-up (right) of underside of "flower" unit. Extra-thick layup in ribs between "petals" and around "stem" add rigidity, provide base for fastening "flower" to "stem."

Isophthalic resins

Isophthalic-based polyester and alkyd resins are now being offered to potential customers on a sample basis by Oronite Chemical Co., a subsidiary of Standard Oil Co. of California. The samples are provided to assist resin and paint chemists in developing their own resin formulas. Oronite, producer of the isophthalic, does not manufacture resins in commercial quantities, but is performing this service so that customers may evaluate the properties imparted to their products by these materials. Several polyester resin producers are now using isophthalic instead of conventional phthalic for their formulations.

Urea for particle board

Comparatively low viscosity and low free formaldehyde are claimed for Catalin Resin 841, a new high-solids, urea-formaldehyde resin for use in the production of particle board according to the Catalin Corp. of America, New York, N. Y.

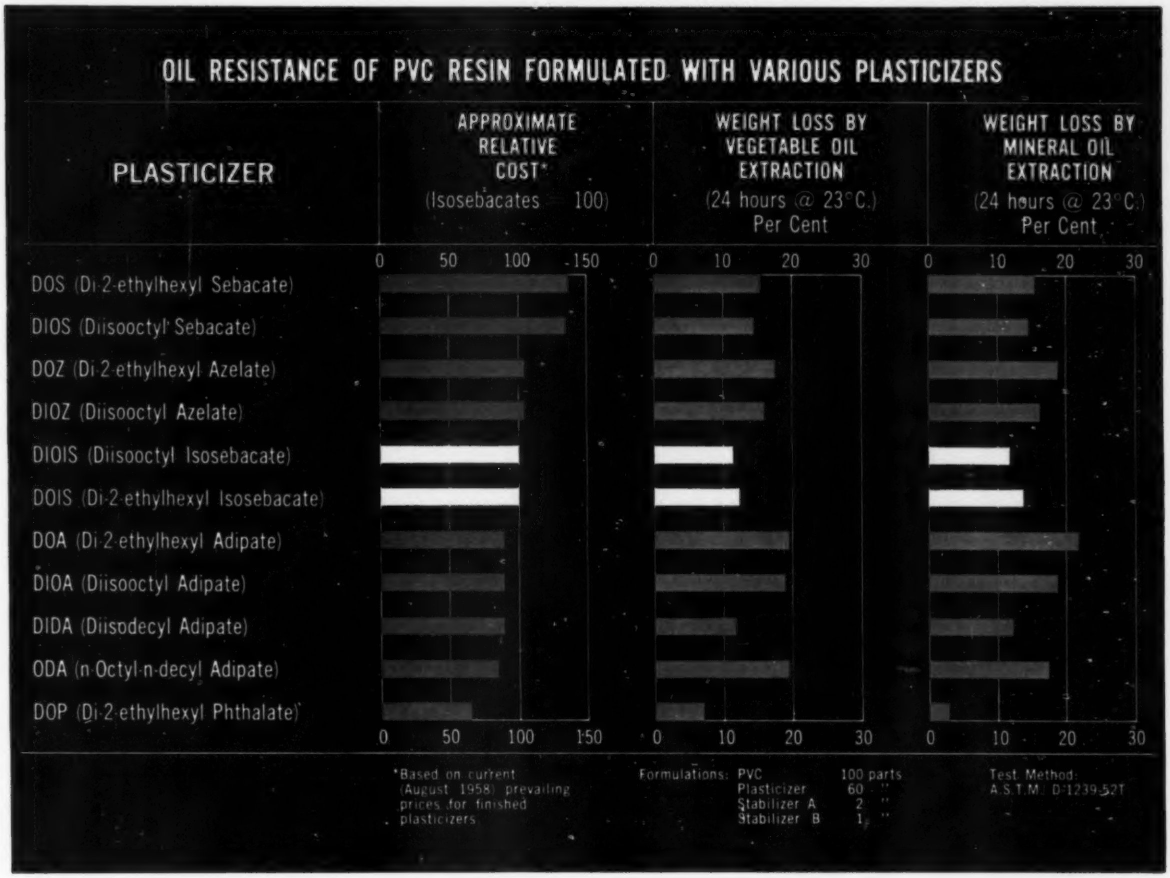
Used in conjunction with its liquid accelerators 7078 and 7074, this resin speeds board production by providing a fast cure with longer assembly time, the company states.

The new resin-accelerator combination is also said to reduce objectionable formaldehyde fumes.

$1 million in new orders

In a period of less than two months over $1 million in new orders have been received by Lunn Laminates, Inc., producer of molded reinforced plastics.

Among the new orders announced by the company are 85 26-ft. long, one piece whale boats for the Navy; fairwaters for aircraft carriers; propeller housings for **(To page 240)**



Esters of ISOSEBACIC® acid show lower oil extraction than more costly vinyl plasticizers

Dioctyl and diisooctyl esters of ISOSEBACIC acid, used as low-temperature plasticizers for polyvinyl chloride, outperform the sebacates, azelates and adipates in resistance to both mineral and vegetable oils. This is shown in the accompanying data from a series of recent tests, along with approximate relative costs of these commonly used vinyl plasticizers.

Oil resistance is a prime requirement of plasticized vinyls for such applications as auto seat covers, garden hose, wallets and footwear. With ISOSEBACIC acid-derived plasticizers, manufacturers can turn out products with superior oil resistance . . . and excellent color, odor, low-temperature flexibility and heat stability as well.

Test Procedure

These oil extraction tests were carried out on 2″ disks die-cut from 10- to 20-mil sheeting prepared by standard milling and pressing procedures. A refinement in the A.S.T.M. method used was pre- and post-conditioning of specimens for 40 hours at 23-24°C. and 50% r.h. before weighing.

DOP was included in these tests since it is relatively inexpensive and is commonly blended with the other plasticizers to increase their compatibility. Although DOP has good oil resistance, it is not used to impart low-temperature flexibility when incorporated in vinyl resins.

New Intermediate Being Evaluated

ISOSEBACIC acid is a new synthetic organic intermediate soon to be produced in commercial quantities at the U.S.I. Tuscola, Ill., plant. It is a mixture of three C-10 dibasic acids – 2-ethyl suberic, 2,5-diethyl adipic and sebacic acids. In addition to its promise as a vinyl plasticizer intermediate, it is being evaluated for polyamides, polyesters, polyurethanes and alkyd resins.

Its interesting properties may offer you opportunities for significant product improvement and cost reduction. Write for samples and literature.

U.S. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Avenue, New York 16, N. Y.
Branches in principal cities

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new super carriers; 18 new jobs in duct components for Fairchild Aircraft; several large volume production for key missile parts for Raytheon Manufacturing; 38 complete sets of Nike radomes through Bowser Corp. There are also large orders from New York Shipbuilding, Brooklyn Naval Shipyards and Newport Shipyards. In addition to the above, Magnavox Corp. placed orders for press molded housings; Electric Boat Corp. for submarine mast structures; and Electronic Supply for General Electric radomes.

Polyester rods

Transparent, unfilled polyester rods are now produced by the Homalite Corp., Wilmington, Del. Designated Homalite 100, the rods are available in ¼-, ½-, ¾-, 1-, 1½- and 2-in. diameters and in lengths up to 36 inches.

According to the company, this material has many times the resistance to abrasion of methacrylate, is unaffected by any known solvent, and withstands temperatures up to 230° F. It can be subjected to substantially higher temperatures for short periods, the company states.

The rods can be sawed, drilled or machined without difficulty. Homalite 100 will not crack, craze, or discolor on exposure to sunlight and the elements. It is said to have a persistent memory for its original shape, high impact strength, and is not brittle even at low temperatures.

New acrylic products

Cast acrylic rods from 0.50 to 2.0 in. in diameter, and blocks from 6 to 24 in. thick have been added to the line of Evr-Kleer products, manufactured by Cast Optics Corp., Hackensack, N. J.

The rods for display purposes, contact lenses, etc., are produced by applying the company's technique for casting sheets. An entirely new casting method is said to be used to produce the blocks which were previously available only in mold sizes. Cast Optics supplies blocks in the exact sizes desired, and provides two polished parallel surfaces at no extra cost. One of the main applications for these blocks is for viewing radioactive matter.

Plastics parts center established

The nation's first permanent exhibition center for plastics parts, materials, and supplies, called Product Designer Displaycase, is being established at New York, N. Y. Similar centers are being planned for the South, Midwest, and Pacific Coast.

The objective of the display is to provide a clearing house of plastics products, materials, and developments where manufacturers can keep abreast of available parts and supplies and obtain full information and specifications on materials of interest to them.

Formal opening of Product Designer Displaycase is set for June 1, but exhibits are already being designed and designers and manufacturers are invited to register permanently, either in person or by letter, with the exhibit center at 1 Park Ave., New York, N. Y. H. Newman Clark is Executive Director of the center.

Gordon Research Conferences

A total of 36 conferences are scheduled for the program of the Gordon Research Conferences for 1959, which will be held weekly from June 15 through September 4. As in previous years, meeting sites will be three New Hampshire campuses—Colby Junior College, New London; New Hampton School, New Hampton; and Kimball Union Academy, Meriden. A detailed schedule, including information about registration procedures, is available from Dr. W. George Parks, Director, Gordon Research Conferences, University of Rhode Island, Kingston, R. I.

Self-extinguishing laminate

A new XXXP grade laminate has been developed by Continental-Diamond Fibre Corp., a subsidiary of The Budd Co., for electrical applications where humid conditions are encountered. It is available in plain sheets in natural color, semi-gloss finish, and is designated Dilecto XXXP-31EFR, or as copper-clad sheets, named Di-Clad 31EFR.

Made from cellulose paper impregnated with epoxy resin, the material is rapidly self-extinguishing and absorbed only 0.35% water after a 24-hr. immersion test. The thicknesses of the Dilecto grade range from 0.015 through 0.25-in., in sheet sizes of 38 by 42-in. and 38-in. square. Thicknesses of the copper-clad material range from 0.032 through 0.25-in. in the same sheet sizes.

Copolymer for film-forming

A new vinylpyrrolidone/vinyl acetate copolymer in solid form has been added to the line of PVP/VA copolymers marketed in 50% alcoholic solutions by Antara Chemicals, sales division of General Aniline & Film Corp. These copolymers have exceptionally good film-forming and adhesive properties, broad solubility range, and exceptional compatibility characteristics, the company states.

Designated PVP/VA S-630, the new copolymer represents a monomer ratio of 60% PVP and 40% VA. The solid form is said to offer special advantages to manufacturers of sizes for glass fibers, adhesives, paper coatings, flexible finishes, etc.

New uses for urethane foam

A process for continuous forming of a lightweight core of polyether foam between kraft paper and combinations of plastics films and foils is offered by J. M. Gordon Laboratories, 200 W. 24th St., New York 11, N. Y. This sandwich structure provides an economical method of producing protective packaging that takes advantage of the lightweight, impact-absorbing, and insulating properties of urethane foams.

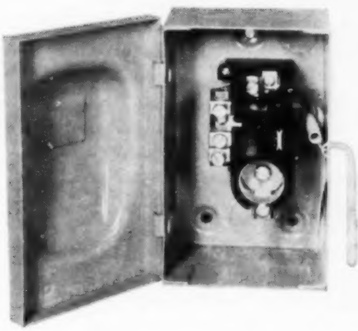
Offers imported vinyl film

Extruded and calendered clear, transparent vinyl film is now available from Robeco Chemicals, Inc., 25 E. 26th St., New York 10, N. Y.

The extruded film, produced in Japan on equip- **(To page 242)**

PRODUCT-DESIGN BRIEFS FROM DUREZ

- **New safety switch idea**
- **Phenolics in data processing**
- **What's hot in heat resistance**



A switch for fumblers

Ever try to change a fuse on a 30-amp switch in pitch darkness?

"No—and why should we?" retort the designers of many such useful devices. "Anyone who doesn't have a flashlight handy for these little emergencies is asking for trouble."

"Yes—and it was a horrible experience," breathes the designer of *this* switch. "Young son had used up all the flashlight batteries at Scout camp. Horrible. Gave me the idea for a switch *anybody* could re-fuse. It works, too."

This insight into the limitations of the average American householder is now helping to swell demand for the 30-amp safety switch pictured here. As you can see, the crossbar that actuates the contact has been moved to the back where it cannot get in the way of fumbling fingers.

To accommodate the new design, a one-piece block of Durez phenolic supplants a two-piece porcelain block. The more compact block of Durez allows extra hand-room for wiring the switch, and weighs less without loss of performance.

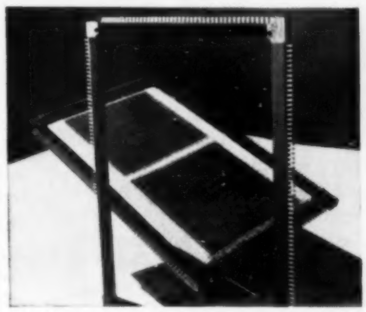
Have you an idea for a better electrical device? The odds are good that one of more than 200 Durez molding compounds can give it the exact mix of properties you want it to have. To narrow the uncertainty, see your molder or write us direct.

Jet-age abacus

With the help of Durez plastics, man can string words and numbers on wire like beads and pick them off again in millionths of a second.

His modern abacus is the IBM magnetic core memory. Thousands of tiny ferrite cores are wired into a frame like the one in the middle of this page. In an array of these core planes, stacked one atop another, electrical impulses alter the magnetic state of cores. A line of cores, some altered, some neutral, stands for a word or number, awaiting the impulse that releases it for calculation.

IBM engineers needed modern materials to bring this jet-age concept into being. The frame that supports the cores must be an excellent insulator. It must be free of internal stress that would cause warping or cracking. During assembly it must withstand the heat of dip soldering without losing its dimensions. Once assembled, it must not shrink or expand.



International Business Machines Corporation

For the core frame, designers and molder chose a mineral-filled Durez phenolic that delivers the ultimate in stability, heat resistance, dielectric strength, and moldability, meeting all requirements.

Other Durez phenolics prove their inborn versatility in the molded circuits of stepping switches, emitters, and zebra plates in new IBM accounting machines.

How much for a handle?

No, you don't really need a slide rule to design a coffeepot handle, but it helps.

This designer, at the moment, is not concerned at all with the compound-curve esthetics of coffeepot handles. He is simply figuring out how many handles his molder can make out of 1,000 pounds of which molding compound, and for how little money.

With the slide rule, it takes him only three and a half minutes to learn that his best bet for *this* handle is likely to be *Durez 1308*. Of the many mineral-filled phenolics we make, this one is in the lower gravity range. More pieces per dollar.

He has already checked into *1308's* other traits: rich black surface, uniform luster, good heat resistance (it withstands 450°F for short periods), low water absorption, flexural and tensile strengths OK.

His molder confirms the choice, for different reasons: he can get *1308* in four different plasticities, can plunger mold it, and it cures fast. Looks as if another good product is off the ground.

You don't design handles? Well, *1308* appears to fit into more heat-resistant applications than any comparable material ever developed: appliance and meter housings, wiring devices, tube bases, sockets, coil forms. The list goes on and on. But we'll stop so you can talk to your molder about *1308* for that next hot-spot job.

For more information on Durez materials, check here:

☐ 8-page Bulletin D400 lists properties, uses, design advantages of Durez thermosetting compounds, Hetron fire-retardant polyester resins, and Durez phenolic bonding resins.

☐ **"Durez Plastics News,"** mailed periodically, shows and describes latest uses of Durez materials.

Clip and mail to us with your name, title, company address. *(When requesting samples, please use business letterhead.)*

DUREZ® HOOKER CHEMICALS PLASTICS

PLASTICS DIVISION

HOOKER CHEMICAL CORPORATION

12005 Walck Road, North Tonawanda, N. Y.

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ment manufactured by Modern Plastic Machinery Corp., Lodi, N. J., is available in 54-in. width and thicknesses from ½ to 4 mil.

Calendered film, 54-in. wide, can be supplied in thicknesses from 1.2 to 20 mil.

New glass cloth

A phenolic-impregnated glass cloth has been developed for use in high-temperature, high-strength aircraft and missile applications by the Electro-Technical Products Div., Sun Chemical Corp. According to the company, the material has a uniform resin to glass ratio.

Designated Sunform F-1760, the new product is available in all standard weaves, finishes and glass cloth, in widths up to 100 inches.

Nylon golf balls

A regulation golf ball with a solid nylon center that adds 10 to 20 yards to the average drive has been developed by the owners of Brass Ram Corp., Bay City, Mich., who are manufacturing this item. The ball, called the Ram, has been used by veteran professionals. It is sold only through pro shops and retails at $1.25.

The reason for the ball's extra yardage is a marble-sized core made from Du Pont's Zytel 101 nylon resin, which replaces the conventional liquid or rubber center.

PVC pipe in chemical plants

For chemical pressure piping systems unplasticized polyvinyl chloride Type I is proving to be the most versatile plastic piping available for general use in the temperature range of 0 to 150° F. This is the conclusion of Harvey E. Atkinson of Du Pont, who discussed recent advances in plastic materials of construction at the 39th National Meeting of the American Institute of Chemical Engineers. He cited one process application involving some 3000 ft. of pipe in sizes ½- to 6-in. with hundreds of fittings and valves, where approximately $40,000 was saved by using this type of plastic piping instead of aluminum, stainless steels, and higher nickel alloys.

In another application, PVC replaced rubber-lined steel piping for handling acid slurries at a saving of $20,000. Some 5000 ft. of pipe was involved.

Polyolefins for rope

A price reduction for 600 denier stabilized polyethylene monofilaments used in the manufacture of floating marine ropes, has been announced by Reeves Brothers, Inc., New York, N. Y. The new price for quantities of 5000 lb. and over is $0.843/lb. for all standard colors. The premium for red and orange is 3¢/lb. The price for 600 denier polypropylene monofilaments remains at $1.00/lb. for quantities of 5000 lb. and more.

The two grades of polymer filaments supplied at present by Reeves are No. 700 linear PE and No. 800 polypropylene (isotactic). Polypropylene has a lower specific gravity and better elongation values than PE, according to Reeves.

According to the Plymouth Cordage Co., Plymouth, Mass., the particularly good elongation properties of polypropylene have reduced creep under constant load and the fiber's exceptional lightness is an advantage in the marine field.

Ropes made from polymer yarns are used for recreational purposes as ski tow lines, safety float lines for beaches, anchor and mooring lines for small boats, swing and jump ropes, and as life lines for rescue kits. Industrial and commercial uses include barrier ropes, safety and signal ropes, and leadlines and cork lines for fishing.

Germ-resistant sheets

Extruded plastics sheets made by Campco Div., Chicago Molded Products Corp., are now offered with Sanitized hygienic treatment. This germ-resistant feature has been incorporated into the materials during the production process and has, therefore, become an integral part of the company's products, Campco claims.

According to the company, the Sanitized process does not alter the physical properties of the plastics materials.

Standards for PVC weatherstripping

The proposed standard for polyvinyl chloride weatherstripping, developed by the Plastics Weatherstrip Manufacturers' Div. of S.P.I., is now in the hands of the National Bureau of Standards, and is expected to be promulgated by the U. S. Department of Commerce in the near future.

In addition, the division is preparing proposed trade practice rules which are to be submitted to the Federal Trade Commission. These rules are directed to the maintenance of free and fair competition in the weatherstrip industry, and to the prevention and elimination of various practices deemed to be violative of laws administered by the FTC. Milton Lax, president of Kreidel Plastics, Inc., is chairman of the division.

Fluorocarbons

New TFE grade. Void-free moldings and electrical tape as thin as 1 mil for wire-wrapping are said to be possible with a new grade now being produced in commercial quantities by Du Pont.

Designated Teflon 7, the new molding and extrusion powder is granulated to ultra-fine particle size. It offers such processing advantages as lower pre-form pressure requirements and uniform density throughout complex molded parts.

Available in volume from new facilities at Du Pont's Washington Works, Parkersburg, W. Va., the material sells for $5/lb. in 24,000-lb. quantity.

For gaskets and seals. A felt material, consisting of pure Teflon fibers impregnated with Teflon resin, is now available from General Plastics Corp., 165 Third Ave., Paterson, N. J.

The felt is suggested for gaskets and seals exposed to severe corrosion and elevated (To page 244)

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temperatures. Being all Teflon, the material will withstand attack by strong acids and bases, is unaffected by water, or any common fuels, lubricants, hydraulic fluids, or solvents, the company points out. The felt can be used continuously from below —100 to 400° F., it is claimed, and under certain conditions the material is said to have been used up to 600° F.

General Plastics Corp. reports that gaskets made of its Teflon felt are still in use after 18 months' exposure to 99.3% sulphuric acid, whereas materials previously used for this application had to be replaced weekly.

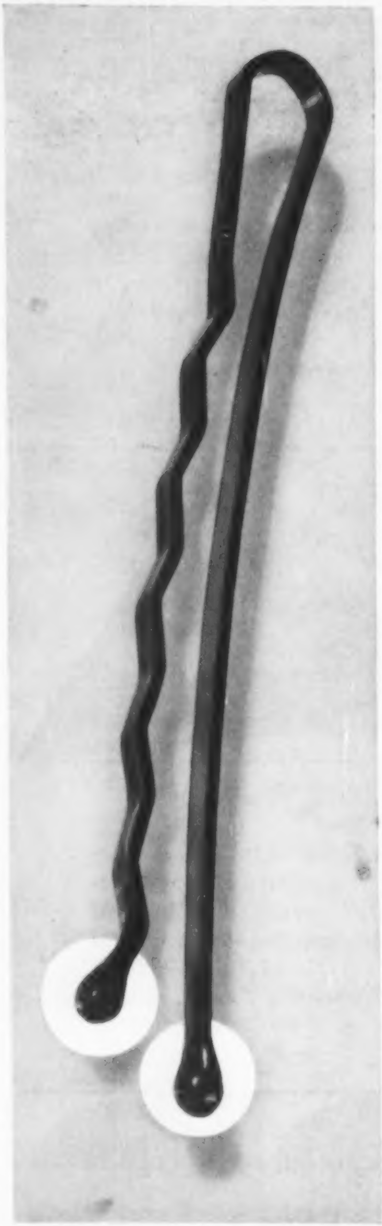
Starts TFE manufacture. A complete line of Teflon sheets, rods, tubes, strips and slabs is now being manufactured by Cadillac Plastic & Chemical Co., in a new $1½ million extrusions building in Warren, Mich.

The line includes sheets up to 2-in. thick, rods and tubes in diameters to 25 inches. The line will be distributed through the 11 regional Cadillac Plastic warehouses and through franchised distributors. The company also offers a Teflon custom coating service.

Recently its appointment as national distributor for Fluorglas Teflon-coated glass fabrics, manufactured by Dodge Fibers Corp. was announced.

Tougher Teflon. By blending inorganic additives with Teflon, Modern Industrial Plastics, Inc., Dayton, Ohio, claims to improve the physical characteristics of Teflon the resin. The blended material, named MIPlon, is said to exceed pure Teflon by a factor of up to 10 in resistance to deformation under load; resistance to wear is increased as much as 500-fold; and compressive strength and stiffness can be increased four to five times, the company states.

MIPlon supersedes the company's former compound, Rilon, and is reported to be an improvement on earlier forms of filled Teflon in its ease **(To page 246)**



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of handling on the production line. The additives, the company said, do not lower Teflon's lubricity, chemical inertness, and other physical characteristics.

Skived tape. Four grades of skived Teflon tape with varying mechanical and electrical properties are available from Continental-Diamond Fibre Corp., a subsidiary of the Budd Co., Newark, Del. The tapes are designed primarily for high-temperature and high-frequency wire and cable insulation, but may also be used as stock for gaskets, seals, and miscellaneous small parts. When treated by CDF with a cementable backing, these tapes can also be used as rub rail covers, hopper or chute liners, etc., where the material's smooth and non-adherent surface prevents jamming of packages or bridging of sticky materials. Tape widths range from ¼ to 12-in. in ⅛-in. increments.

Ribbon dope. A better method of pipe joint sealing is said to be possible with Permacel 412 ribbon dope produced by Permacel, New Brunswick, N. J. The new dope comes in roll form in 260- and 520-in. lengths with each roll packaged in an individual dispenser box. According to the company, a 260-in. roll will make up to 100 1-in. pipe joints.

Custom coatings. Improved coating techniques and custom-built equipment for Teflon and other fluorocarbon coatings are now offered for experimental or production purposes by Industrial Plastic Coating Corp., 83 Wabash Ave., Clifton, N. J.

New companies

Leon Chemical Industries, Inc., 2841 E. Eleven Mile Rd., Warren, Mich., formed by **Arthur S. Nicholas,** pres., and **Robert Cox** to produce acrylic coatings for glass and metals, paint intermediates and formulated epoxy.

Amaco, Inc., 2601 W. Peterson Ave., Chicago 45, Ill. will specialize in processing and production layout for the plastics and chemical industries. **Gerard Ziffer** is pres.

Libbert Plastics, Inc., 5331 White Settlement Rd., Fort Worth, Texas, custom injection molding company. The new firm will also carry on the services previously offered by **Libbert Tool & Die. Gene Libbert** is pres. **Glenn Gerlich** and **Alex Warfield** are VPs.

Bellerton Electronics, Inc., 219-08 130th Ave., Laurelton 13, N. Y., to serve the heat sealing trade as consultant, designer, and assist with automation. The company was formed by **Bob Zucker,** formerly dir. of heat sealing operations of Climatic Rainwear and Plastic Innovations.

Geo. S. Scott & Sons Mfg. Co., Inc., 26 Cherry St., Meriden, Conn., a custom compression and transfer molder. Equipment includes injection molding machines up to 16 oz., and thermoset molding equipment up to 200 tons. **George S. Scott,** formerly owner of U. S. Plastic Molding Corp., Wallingford, Conn., is pres. and gen. mgr. **Donald Smith** is plant supt.

Wayne Machine & Die Co., 375 Broadway, Passaic, N. J., formed to manufacture extrusion screws for machines ranging in size from ¾ to 8 in. in diameter. **J. P. Scuralli** is pres.

Expansion

The Logo Div. Bee Chemical Co., with headquarters in Chicago, Ill., expanded its West Coast operations by acquiring new quarters at 17000 So. Western Ave., Gardena, Calif., for warehousing of the firm's coatings and metallizing finishes, and to house a new sales service laboratory for customers in the Los Angeles area.

U. B. S. Chemical Corp. is constructing a pilot plant and laboratory in Marlboro, Mass., which is scheduled for completion in June. The new buildings, to be settled on part of an 18-acre site, will house a polymer development laboratory and a **(To page 248)**

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small scale production plant. Major production will continue at home plant in Cambridge, Mass.

Allied Chemical Corp. completed new phthalate ester plasticizer facilities at the Toledo, Ohio plant of the Plastics & Coal Chemicals Div. The new facilities will serve the Midwest by direct bulk and drum shipments as well as through six bulk stations located in major cities.

Cyanamid of Canada, Ltd., a subsidiary of **American Cyanamid Co.,** will spend more than $1,500,000 in converting its plant facilities at St. Jean, Quebec, for the production of Formica laminated plastics. The conversion will increase the 17,000 sq. ft. of floor space by more than 50% in order to house the new machinery necessary for the production of Formica. This material is already being produced at St. Jean, using a semi-finished product imported from the U. S. and completed at the Canadian plant.

It is expected that construction will be completed in one year.

Pelron Corp., Lyons, Ill., has completed installation of equipment which doubles its output of flexible polyether-type urethane resins and prepolymers. The new facility provides added capacity of 8 million lb. annually.

Sohio Chemical Co., a subsidiary of **The Standard Oil Co. of Ohio,** broke ground at Lima, Ohio, for a multi-million dollar petrochemical plant for the manufacture of acrylonitrile, based on a new process developed in the company's research center in Cleveland. Construction is to start immediately with the completion date scheduled for early in 1960. This is said to be the first commercial plant in the world to make acrylonitrile from propylene, ammonia, and air.

Gulf Oil Corp. will construct a new multi-million dollar plant at its Philadelphia, Pa., refinery, primarily for production of isooctyl and decyl **(To page 250)**

THE PLASTISCOPE

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alcohols, but which will quadruple the company's capacity to produce Oxo products and a broader range of alcohols. Construction is scheduled to start this summer with initial operations to begin in the summer of 1960. This is the first major petrochemical installation at Gulf's Philadelphia Refinery.

Camdale Corp., New York, N. Y., which owns producing oil properties in Texas and Kentucky, has moved into the plastics field by acquiring a controlling interest in **Commercial Fibreglas Products, Inc.**, 1937 Milby, Houston, Texas, and has transferred its home offices to 828 Niels Esperson Bldg. in Houston.

Commercial Fibreglas, organized in 1957, has grown from three employees to 70, and its boat production annual gross revenue has increased from $80,000 to $170,000, with this year's schedule estimated to reach $900,000 in gross revenue. **Glen L. Corcoran** is pres. and design engineer.

Swedlow, Inc. has installed a specially designed polishing machine for improvements of optical properties of 84- by 84-in. transparent stretched acrylic glazing sheets and other thermoplastic materials in its expanded Los Angeles, Calif., facilities. The new machine will double present capacity.

The device is used to improve the optics of the original material after multiaxial stretching to increase toughness. These properties are retained in forming the sheets into finished enclosures for high speed aircraft.

Techline Div. of Wheelabrator Corp. opened new warehouse and processing laboratory facilities at 2602 E. Foothill Blvd., Pasadena, Calif. The Techline Div. makes precision finishing equipment for wet blasting and barrel finishing units.

Reichhold Chemicals, Inc. has announced its intention to purchase **Alkydol Laboratories, Inc.**, Chicago, Ill., manufacturers of a wide range of synthetic resins, including alkyds, polyester coating resins, wrinkle vehicles, epoxy resins, coating resins for the reinforced plastics, surface coating, adhesive, paper, ink and allied industries.

Alkydol Laboratories is expected to be operated as a division of RCI, with **Dr. Adolph Heck** continuing as president of the division and **Dr. Howard C. Woodruff,** tech. dir.; **H. S. Julsrud,** sales mgr.; **James Basil,** prod. mgr.; and other key Alkydol personnel also remaining.

Imperial Rubber Mfg. Co., Inc., Hackettstown, N. J., is opening a new plant near its present location for the custom compounding of polyethylene for use as cable jacketing and insulation stock.

The plant is a new, modern, one-story structure containing 19,000 sq. ft. of floor space. Two No. 11 Banbury mixers and related equipment are being installed with one mixer to be used exclusively for PE compounds and the other for neoprene compounds.

When completed, the new plant will have daily capacity of 25,000 lb. of PE compounds and 25,000 lb. of neoprene compounds. Limited production quantities are immediately available through present facilities.

Bel-Art Products has acquired the assets of the **E. J. Kanter Co., Inc.**, Chicago, Ill., and transferred all of Kanter's machinery and equipment to the new Bel-Art plant in Pequannock, N. J. Included in the equipment are roll leaf stamping machines which will enable Bel-Art to open a new imprinting department.

Bel-Art Products now operates an acetate fabrication department, a polyethylene fabrication division (B-A Polyethylene Laboratory Ware), a sewing department, and a vacuum forming department as well as facilities for coating of polyethylene on metal parts.

Riverside Plastics Corp., Hicksville, N.Y., has purchased the **Bishoff Chemical Corp.,** Ivoryton, Conn., owned by Miles Laboratories, to obtain specialized facilities for producing new resins with superior character- **(To page 252)**

THE PLASTISCOPE

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istics for high temperature applications. The specialized resins have been developed through Riverside's research program and include phenolics that are said to have withstood exposure to 1400° F., and epoxies that have been successfully exposed to temperatures of 600° F.

Meetings

Plastics groups

May 22: Society of Plastics Engineers, Inc., Northern Indiana Section, Fort Wayne, Ind. RETEC on encapsulation, printed circuits and fluidized bed process.

May 25, 26: The Society of the Plastics Industry, Inc., SPI Cellular Plastics Division Furniture Conference, Sedgefield Inn, Greensboro, N. C.

June 4, 5: The Society of the Plastics Industry, Inc., SPI Film, Sheeting & Coated Fabrics Div. Conference, Concord Hotel, Kiamesha Lake, N. Y.

June 17-27: International Plastics Exhibition & Convention (formerly British Plastics Exhibition & Convention), Olympia, London, England.

June 19: Society of Plastics Engineers, Inc., Detroit Section, RETEC on plastics in the automotive industry.

Other meetings

May 20, 21: Chemical Market Research Association. Annual Meeting. Plaza Hotel, New York, N. Y.

May 25-27: Technical Association of the Pulp & Paper Industry, 10th TAPPI Coating Conference, Statler Hotel, Boston, Mass.

May 25-28: American Society of Mechanical Engineers, 4th Annual Design Engineering Show. Concurrent conferences. May 26: "Latest Developments in Plastics for High Temperature Service." Convention Hall, Philadelphia, Pa.

June 11-13: The Manufacturing Chemists' Assn., 87th Annual Meeting, The Greenbrier, White Sulphur Springs, W. Va.—**End**

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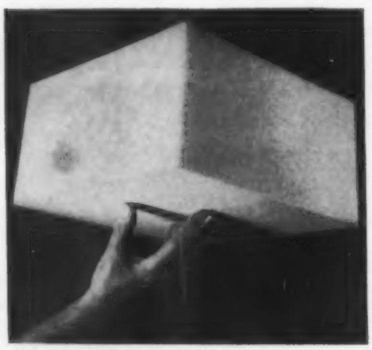

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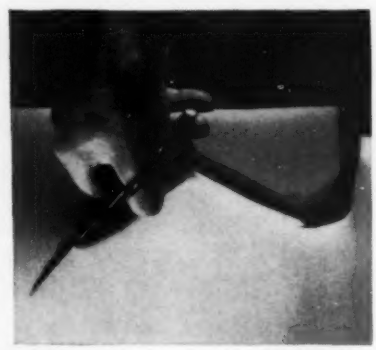

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COMPANIES . . . PEOPLE

Appointments, promotions, and relocations in the plastics industry.

Union Carbide Corp., Union Carbide Chemicals Co.: Robert L. Duncan appointed dir.—product marketing. **Robert C. Boltz** named sales mgr. in charge of Carbide's sales forces. **Philip G. Magnusson** named product sales mgr. for plasticizers, monomers, and higher alcohols.

J. R. Howell promoted from asst. dist. mgr.—Chicago, Ill., to dist. mgr. —Albany, N. Y. He is succeeded by **Russell W. Martin,** previously a tech. rep. in Chicago. **Carl D. Preston** promoted from tech. rep. to asst. dist. mgr. in New York, N. Y.

Edward B. Cass, Paul G. Horecka, Leland S. Kendall, Richard J. Spath, and **J. William Walter** named tech. reps. in Chicago, Ill., New York, N. Y., Newark, N. J., Atlanta, Ga., and Chicago, Ill., respectively.

Monsanto Chemical Co.: Alden N. Crawford, formerly product promotion mgr. in the Plastics Div., Springfield, Mass., appointed asst. corporate advertising mgr.

Plastics Div., Texas City, Texas: **Robert E. Cairns** and **Dr. Byron L. Williams** named asst. research dirs. **Seaton L. Hunter** appointed an assoc. research dir. **Dr. David W. McDonald** promoted from group leader to section leader. **Robert G. Roth** now a group leader.

Chester L. Knowles, Jr. joins the planning group of the engineering dept. at Springfield, Mass.

National Starch & Chemical Corp. is the new corporate name of **National Starch Products, Inc.,** because a substantial part of the company's sales are in chemical products. National starch produces vinyl acetate polymers and copolymers in emulsion form for the adhesive, packaging, paper, textile, paint, and other industries.

Hooker Chemical Corp., Durez Plastics Div.: James W. Ferguson named mgr.—field sales.

Eastern Chemical Div.: Charles Y. Cain appointed asst. sales mgr. **Charles W. Selover** named mgr. of purchases. He will also continue as mgr. of purchases for the Durez plants at N. Tonawanda, N. Y., and Kenton, Ohio.

Continental-Diamond Fibre Corp.: F. M. Grauer, VP, assumes complete responsibility for the company's product pricing, advertising, and public relations, and will also represent CDF in various trade association activities and external relations. **A. J. Briggs,** gen. sales mgr., is now responsible for the over-all direction of CDF sales and marketing activities. **H. M. Dexter,** dir. of sales, will serve with Mr. Briggs as exec. sales consultant until his Nov. retirement. **W. T. Shugg,** mgr.—marketing services, now responsible for sales office administration at CDF's four plants.

Foster Grant Co., Inc.: J. Joseph Kelly named gen. mgr. of the newly created Plastics Sales Div. **John W. LaBelle** appointed exec. asst. to **Dr. Robert L. Purvin,** exec. VP. He will coordinate activities between the sales div. and production, and liaison between sales and R & D. **Dr. Sidney Baum,** VP, continues to direct the production activities of the company's line of polymer products. **Francis V. Duffy** named field sales mgr. of the new div., and **James H. Barry** is sales service mgr.

Kelly **LaBelle** **Duffy**

Harry Silverstein and **Paul Van Heek** named project leaders in the R & D laboratories. **Michael Dovich** appointed project engineer in the Research Div.

Goodyear Tire & Rubber Co.: Ben M. Stephens, previously mgr. of the company's Lincoln, Neb. plant, named mgr. of the molded and extruded rubber and plastics plant at St. Marys, Ohio. He replaces **A. A. Teisher,** who retires.

Plastics Dept.: L. C. Keller named sales engineer responsible for sales activities connected with Pliovic vinyl dispersion resins.

Films & Flooring Div.: Charles H. Smith, Robert J. McLaughlin, and **Richard J. Polka** named packaging film reps. at Philadelphia, Pa., Cincinnati, Ohio, and St. Louis, Mo., respectively.

Goodyear Aircraft Corp.: Russell B. Keller, Jr. joined the project engineering staff of the plastics engineering dept.

Sartomer Resins, Inc., Philadelphia, Pa.: **Daniel J. Gowman** appointed VP in charge of the Essington, Pa., plant operations. **John A. Cornell** named dir. of research. Mr. Sartomer is a custom mfr. of acrylic polymers and monomers.

The Fellows Gear Shaper Co. transferred the headquarters of gen. sales mgr. **George H. Sanborn,** and asst. gen. sales mgr., **Stewart Barton,** from Detroit, Mich., to the main plant in Springfield, Vt. The branch office in Detroit will be continued with **A. R. Tobin** as mgr.

National Rubber Machinery Co.: R. K. Senn named mgr.—Extruder Sales Div., succeeding **Hans Buecken,** who formed his own company and will represent NRM on the West Coast. **Len Turk** promoted from coordinator to operation mgr. of extruder sales.

Whitso, Inc., Schiller Park, Ill.: **William F. Brown,** previously sales mgr. in charge of injection molding for Chicago Molded Products Corp., named sales mgr. **J. Harold Campbell** promoted from chief engineer to mfg. dir. Whitso is a custom molder and mfr. of insulated terminals and electrical components.

Shell Development Co.: Dr. F. E. Condo appointed acting dept. head—thermoplastics at the Emeryville, Calif., research center.

Phillips Petroleum Co., Foreign Sales & Development Dept.: R. J. Hull appointed mgr.—rubber chemicals and plastics sales. **R. E. Elliott** and **R. G. Askew** are asst. mgrs. of these sales. **A. E. Buell** succeeds **M. W. Conn** as mgr. of the market development div. of the R & D dept.

Engineered Plastic Products, Inc., Stirling, N. J.: **George Hackett** joined as VP and gen. mgr. **Joseph Sebestyen** named production supt.

Robert J. Brockman, previously VP for West Coast operations, now heads the Plastics Div. of **Sefton Fibre Can Co., Container Corp. of America.**

Samuel Chum Torno, VP, **Danforth Wines, Ltd.,** Toronto, elected pres. **Packaging Assn. of Canada.**

Julius Mate appointed tech. and sales rep. for western Ohio, Pa., and western N. Y., for **The National Tool & Mfg. Co.,** Kenilworth, N. J.

Elmer F. Myers transferred from the Southeast territory to Akron, Ohio as asst. dist. mgr. for **Farrel-Birmingham Co., Inc.** He is succeeded by **Stanley J. Budzik.**

Robert M. Henderson, formerly with the market research dept. of American Cyanamid Co., named dir.—market research div., **Petroleum Chemicals, Inc.** PCI, with headquarters in New Orleans, La., operates a plant at Lake Charles **(To page 256)**

COMPANIES...PEOPLE

(*From page* 255)

La., where butadiene, ammonia, ethylene, propylene, and ethylene oxide-glycol are manufactured from petroleum hydrocarbons.

William A. Morton named asst. research mgr., Organic Chemicals Research Laboratory, **Dewey & Almy Chemical Div., W. R. Grace & Co.,** Cambridge, Mass.

Leonard W. Mawhinney appointed exec. advisor to the pres., **Metal & Thermit Corp.,** Rahway, N. J.

Talmage W. Cobb named sales rep. for **Harwick Standard Chemical Co.,** with headquarters at Greenville, S. C.

Robert S. Roseman appointed mgr. of the **Plax Corp.'s** Stonington plant succeeding **Clarence W. Coe,** who died recently.

Daniel G. Everett joined **Commercial Plastics & Supply Corp.'s** Philadelphia, Pa., branch.

William D. O'Morrow named VP in charge of sales of **Wasco Chemical Co., Inc.,** Cambridge, Mass.

Richard C. Phelps appointed customer service group leader for **U. S. Industrial Chemicals Co.,** to supervise tech. service to customers for Petrothene polyethylene resins.

John W. Lyon named VP in charge of manufacturing, **General Binding Corp.,** Northbrook, Ill., mfr. of plastic binding equipment and supplies.

Jean L. Lewis, formerly asst. chief, Chemicals & Plastics Div., Quartermaster Research & Engineering Laboratories, Natick, Mass., named tech. dir., **Eli Sandman Co.,** Worcester, Mass.

Albert W. Fuhrman named VP in charge of the Chemical Div., **Great American Plastics Co.,** Fitchburg, Mass.

Paul V. Brown appointed mgr.—manufacturing of the La Verne, Calif., plant of **Taylor Fibre Co.** The plant produces industrial high pressure laminated plastics.

Charles J. Garvey named to assist **Joseph J. Tierney,** div. mgr., Plastic Tooling Div., **Houghton Laboratories, Inc.,** Olean, N. Y.

Donald E. Wolff named to the newly created post of tech. service mgr., Plastics Div., **Seiberling Rubber Co.**

Dr. Clarence F. Hammer, a supv. in the R & D Div. of the Polychemicals Dept. at the experimental station near Wilmington, Del., has been

transferred to the new Du Pont linear polyethylene plant in Orange, Texas, to head a research group which will make special studies on linear polyethylene.

Thomas W. Kreiner named S. W. regional sales mgr. for **Carlon Products Corp.**, Aurora, Ohio. He will maintain offices at the company's Corsicana, Texas, plant.

Dr. Robert B. Mesrobian appointed gen. mgr. of paper and plastic container research and development for **Continental Can Co.** Paper and plastic container R & D will be housed in a new laboratory to be constructed in Chicago, Ill., as an addition to the company's tech. center in that city.

Charles E. Hurtle promoted from chief engineer to sales engineer specializing in the field of blown film, flat film, and monofilament equipment of **Robbins Plastic Machinery Corp.**, Elkhart, Ind. He is succeeded by **James I. Tweedy.**

William Buckingham appointed asst. production mgr. of custom molding, **Watertown Mfg. Co.**, Watertown, Conn.

Herbert R. Herman appointed chief chemist, **Fiberfil, Inc.**, Warsaw, Ind.

Donald R. Long named plant mgr. of the **Borden Chemical Co.'s** Illiopolis, Ill., operation.

Dr. J. H. Saunders named dir. of research, **Mobay Chemical Co.** He succeeds **Dr. E. E. Hardy**, who joins Monsanto Chemical Co.'s Plastics Div.

Ed. J. Lynch, P. O. Box 3043, Santa Ana, Calif., appointed sales rep. for **Davis-Standard, Div. Franklin Research Corp.**, Mystic, Conn. He will handle the company's line of thermoplastic extruders and wire line machinery on the West Coast.

Charles M. Coffin named VP—mfg., **B. F. Goodrich Industrial Products Co., Div. of The B. F. Goodrich Co.** He succeeds **Rollin D. Hager**, who is on extended leave of absence.

Gerald Kerstein named VP and sales mgr. of **The Blane Corp.**, Canton, Mass., mfrs. of vinyl insulation compounds and vinyl color concentrates.

Floyd F. Rechlin, widely known in aircraft and missile manufacturing circles, appointed structural research specialist for the R & D Div. of **Narmco Industries, Inc.**

Saul Ricklin appointed dir. of development, **Dixon Corp.**, Bristol, R. I., manufacturers of Rulon fluorocarbon products.

Charles G. Chason elected pres., **Wilner Wood Products Co., Inc.**, Norway, Me. He succeeds **(To page 258)**

COMPANIES ... PEOPLE

(From page 257)

Joseph Wilner, founder of the company, who retired. **The Wilner Co.** claims to produce a major portion of the wood flour used by the plastics and linoleum industries in the U. S.

S. E. (Prof) Werner will head the new sales office, warehouse and bulk storage depot of **Colton Chemical Co., Div. of Air Reduction Co., Inc.**, at 209-15 S. Franklin St., Tampa, Fla.

Daniel Smith named dir. of the color center of **Interchemical Corp.** He succeeds **F. L. Wurzburg, Jr.**, who is returning to the company's Printing Ink Div.

Baker Perkins, Inc.: M. F. Filiatraut appointed production supt., succeeding **Jack Price**, who retired. **William A. Barnwell, Jr.** named a chemical sales rep. for the Chemical Machinery Div.

Leonard E. Canner named VP—production of **Landers Corp.**, makers of coated fabrics.

New reps.

Ac-cello Products Co., 122 E. 42nd St., New York, N. Y., appointed Eastern sales rep. for the Plastics Div., **Seiberling Rubber Co.** . . . **Glabman-Teichner, Inc.**, 666 Lake Shore Dr., Chicago, Ill., named Midwest rep. for **The Barr Corp.**, Richmond Hill, N. Y., for their complete line of quilted vinyl film and sheeting . . . **Central Ohio Paper Co., Roofings & Materials Div.**, 227 Neilston St., Columbus, Ohio, is distributor for Durethene polyethylene film made by **Koppers Co., Inc.** . . . **Plastic Molders Engineering Co.**, 55 E. Washington St., Chicago, Ill., named Chicago sales rep. by **Thoreson-McCosh, Inc.** Detroit, Mich., mfrs. of granulating machines, heating equipment, and other machinery for the plastics industry . . . **Ferber Trading Corp.**, 42 W. 33rd St., New York, N. Y., appointed exclusive U. S. sales rep. for molds made by **Societe de Produits Industriels**, (Prodel), Paris, France . . . **H. P. Greenberg Co., Inc.**, New York, N. Y., named sales agents for Coflex outer-wear vinyl fabrics manufactured by **Cotan Div., Interchemical Corp.**, Newark, N. J. . . . **Duplex Metals, Inc.**, 7500 Natural Bridge Rd., St. Louis 21, Mo, appointed St Louis rep. by **Atlas Mineral Products Co.** for their line of corrosion-proof construction materials.

Correction

"The Urethanes grow up." (MPL, March 1959, p. 96). Armrests shown in the photograph were manufactured by **The Davidson Rubber Co.**, Charlestown, Mass. The process described in the accompanying text was developed by the company.—**End**

CLASSIFIED ADVERTISEMENTS

EMPLOYMENT • BUSINESS OPPORTUNITIES • USED OR RESALE EQUIPMENT

Machinery and Equipment for sale

FOR SALE: 5—Unused Baker Perkins size 15 JIM2, 100 gal. steam jacketed double arm Mixers; 1—Baker Perkins size 16 TRM, 150 gal double arm Mixer; 1—Ball & Jewell #1 Rotary Cutter; 1—Kent 6" x 14" three roll Mill; 6—Stokes Model DD2, DS3, D3 and B2 Rotary Preform Presses; 4—Stokes Model "R" single punch Preform Presses. Also: Sifters, Banbury Mixers, Powder Mixers, etc., partial listing; write for details; we purchase your surplus equipment. Brill Equipment Co., 2407 Third Ave., New York 51, N.Y.

FOR SALE: Ovens, Grinders, Powder Mixers, Injection Molding Machines 1 oz. to 60 ozs. never used and used. Two-head Bottle Blowing Machine. Acme Machinery & Mfg. Co., Inc., 20 South Broadway, Yonkers, N.Y. YOnkers 5-0900, 102 Grove Street, Worcester, Mass. PLeasant 7-7747. 5222 W. North Ave., Chicago, Ill. TUxedo 9-1328.

FOR SALE: Baldwin-Southwark 200 ton semi-automatic transfer molding press. French Oil 250 ton 38" x 28". 200 ton hobbing press. 200 ton 16" record presses. French Oil 120 ton self-contained. Hydraulic pumps and accumulators. ¾ oz. Bench Model Injection Machines. Van Dorn 1 to 2½ ounce. Lester 16 oz. & Reed 22 oz. Other sizes to 100 oz. Baker-Perkins and Day jacketed mixers. Ball & Jewell #2 Plastic Grinders and other sizes. Seco 6" x 12" and 8" x 16" mills and calenders. Hartig 3¼" Plastic Extruder. MPM 2" and MRM 1". Thropp 3" x 8" Lab. two roll Plastic Mill. Single and Rotary preform presses ½" to 4". Partial listing. We buy your surplus machinery. Stein Equipment Co., 107-8th St., Brooklyn 15, New York.

MOST MODERN PACKAGING AND PROCESSING MACHINERY: Available at great savings: Package Machinery, Hayssen, Scandia Wrap King, Miller Wrappers. Pneumatic Scale Automatic Carton Feeder, Bottom Sealer, Wax Liner, Top Sealer with interconnecting Conveyors. Pneumatic Scale Tite Wrap. Fitzpatrick Model D-6 Stainless Steel Comminuters. J. H. Day and Baker Perkins 50 and 100 gal. Steam Jacketed Steel and Stainless Steel Double Arm Mixers. Day, Robinson 50 to 10,000 lbs. Dry Powder Mixers. Jaceted and Unjacketed Werner & Pfleiderer 3,000 gal. and 3,500 gal. Jacketed Double Arm Mixers Baker Perkins, from 2 to 100 gal., Double Arm Mixers. Jacketed and Stainless Steel. Colton 2RP, 3RP, 3B, 5½T Tablet Machines. Stokes DD2 and Eureka Tablet Machines. Complete Details and Quotations Promptly Submitted. Union Standard Equipment Company, 318-322 Lafayette Street, New York 12, N. Y. Phone: CAnal 6-5334.

FOR SALE: 2 plastics mills, 22" x 60" and 18" x 50"; 2 Cumberland 7" stair step dicers, stainless steel; 4 compression molding presses, 470, 200, 100 and 40 tons; 1 Defiance #20 preform press; 1-100 cu ft jacketed steel ribbon blender; also extruders, mixers, presses, etc. Chemical & Process Machinery Corp., 52 9th St., Brooklyn 15, N. Y. HY 9-7200.

FOR SALE: 1-Robinson #1630 Plastic Cutter with 30 HP explosion proof motor, late model, excellent condition, attractively priced. Reply box 5501, Modern Plastics.

FOR SALE: Spare parts for 8-12-24 oz. Reed-Prentice molding machines; cylinders, tie bars, pumps, motors, aluminum heater bands, etc. American Molded Products, 2727 W. Chicago Ave., Chicago 22, Ill.

FOR SALE: 43—Baker-Perkins #17, 200 gal. jktd. mixers, sigma and duplex blades, many with individual 30 HP motors and drives, power-screw tilts. 2—Baker-Perkins 100 gal., sigma or dispersion blades, jktd. 3—Baker-Perkins 50 gal., sigma blades, jktd. 2—J. H. Day 35 gal. sigma blade. Perry Equipment Corp., 1429 N. 6th St., Phila. 22, Pa.

FOR SALE: Lester 20 oz. injection molding machine. Model L-3-15-20 LAS in excellent condition. Serial #591. Priced reasonable, can be seen in operation. Reply Box 5502, Modern Plastics.

FOR SALE: Modern 3000 ton 12-Opening Press by Becker & Van Huellen. Platens 78" x 39" with Pump Unit, loader and unloader. 2000 ton 6-opening Press by Siempelkamp, Platens 12'9" x 7'6". 1200 ton 8-opening Press by Fielding & Platt, Platens 60" x 60". Many Other Large Presses. Reed Brothers (Engineering) Ltd. Replant Works, Woolwich Industrial Estate. London S.E. 18. Cables:—Replant. London.

FOR SALE: Gehnrich 1956 direct gas fired recirculating type conveyor oven, designed and built for precise control of plastic materials. Embodies all safety and control equipment. Sacrifice price. Banner Tire Co., 161 Eastern Ave., Lynn, Mass. Telephone LY 5-0442.

FOR SALE: 1¼" lab extruder, complete with vari-drive, long barrel. 6" x 13" lab mill, motor drive in base. 8 oz. Reed-Prentice injection molder, double link, late type, complete with controls. Two Peco fully automatic 4 oz. injection molders, very fast machines, new in 1956. A complete line of calenders, mills, tablet presses, hydraulic presses, mixers, etc., etc. When you think of plastic machinery, think of—Johnson Machinery Company, 683 Frelinghuysen Avenue, Newark 5, New Jersey.

FIRST CLASS EQUIPMENT FROM YOUR FIRST SOURCE: 2 Roll Mills: 30", 42", 60" Heavy Duty Jacketed Mixers Dbl. Arm: Baker Perkins in all sizes Lab. to 300 Gal.; Dbl. Ribbon Blenders all sizes; Tumbling Cone Mixers to 300 cu. ft.; Rotary Cutters Plastics-Rubber; Preform Presses by Stokes, Colton, Kux. Inquire about the FMC Rental-Purchase Plan. Equipment pays for itself. First Machinery Corp., 209-289 Tenth St., Brooklyn 15, N. Y., STerling 8-4672.

FOR SALE: H.P.M. Rubber Injection molders, 21½"x28" mold space, steam heated platens. Watson-Stillman 300 ton semi-automatic compression molding press (1947) self-contained mold size 34"x27". Watson-Stillman 250 ton 28"x24". Watson-Stillman 140 ton 22"x16". Waterbury Farrel 85 ton 20"x24". W.F. 63 ton 15"x15". Laboratory presses—15 ton 10"x 8" and 10 ton 6"x6" platens. (2) 8 ounce Reed Prentice injection molding machines and (1) 8 ounce Lester Phoenix (late) with nylon attachment. Scrap cutters, valves, accumulators. Hydraulic Presses—all sizes. Aaron Machinery Co. Inc., 45 Crosby St., New York, N.Y. Tel.: WAlker 5-8300.

Machinery wanted

WANTED TO BUY: Used injection molding machines, oven, granulators. One machine or complete plant. Acme Machinery & Mfg. Co. Inc., 20 South Broadway, Yonkers, N.Y. YOnkers 5-0900, 102 Grove Street, Worcester, Mass., PLeasant 7-7747, 5222 West North St., Chicago, Illinois, TUxedo 9-1328.

WANTED: 1 or 2 8 oz. Reed Prentice 10 D 8 with 12 oz. Cylinder. Year 1955 or later and preferably model #1530 with serial numbers of approx. 62600 or higher. Will pay top dollar for excellent condition. Polymold Plastics, Inc., 3417 No. Western Ave., Chicago 18, Ill. Phone Diversey 8-4196.

WANTED: Used Vacuum Metallizer 48" or Larger. Horizontal Type. Reply Box 5503, Modern Plastics.

WANTED TO PURCHASE: We wish to purchase two (2) used Extruders 2½" up to 6" electrically heated, screw ratio 20 to 1 or 24 to 1. Must be in first class condition and late model. Wire or write giving complete information: To Auburn Plastics, Inc., Auburn, New York.

WANTED: Model 200-D-3 Stokes Press, state age, condition and full particulars. Durant Mfg. Co., 12th and Clark St., Watertown, Wisc.

Materials for sale

MATERIALS FOR SALE: Molding Powder Utility Grade, Pastel Colors, Toy Colors, Black General Purpose, Medium Impact, High Impact Polystyrenes. Many surplus lots Virgin Pellets. Polystyrenes Attractive Colors. Reed Plastics Corporation, 116 Gold Street, Worcester 8, Massachusetts.

PLASTIC SCRAP: Teflon, fused white, ground & unground; Mylar, film, clear; Vinyl, black; Vinyl, purgings, asstd. colors; Poly, film, trim clear; Poly, film, rolls, clear; Poly, bags, contains milk powder residue; Acetate, extruded, film, trim, clear; Acetate, extruded, film, rolls, clear. For details, phone, write, wire—Harry Kaufman Co., 1311 W. 13th St., Kansas City, Mo.

VINYL HEAT SEAL: 10¢ per pound in lots of 25 drums. VYHH-VYNS in MIBK, and MEK, etc. Approximately 20% solids. Assorted Colors. Every drum checked and filtered. Ideal for laminations if color is not important. Vinyl Dispersions, Inc., 410 Frelinghuysen Ave., Newark, N. J.

Materials wanted

WANTED: Vinyl and Polyethylene Scrap. Send description and small sample. We are continuous buyers. American Vinyl Corp., 73-30 Grand Ave., Maspeth 78, N.Y. Tel.: DEfender 5-9200.

WANTED: Plastic of all kinds—virgin, reground, lumps, sheet and reject parts. Highest prices paid for Styrene, Polyethylene, Acetate, Nylon, Vinyl, etc. We can also supply virgin & reground materials at tremendous savings. Address your inquiries to: Gold-Mark Plastics Compounds, Inc., 4-05 26th Ave., Long Island City 2, N. Y. RAvenswood 1-0880.

WANTED: All types of plastic scrap and surplus inventories such as: styrenes, butyrates; acetates, acrylics and polyethylenes in any form. Write, Wire or Phone Collect. Humboldt 1811. Philip Shuman & Sons, 15-33 Goethe Street, Buffalo 6, New York.

QUICK CASH: for all types and forms of styrene scrap. Vacuum metallized and plated styrene, styrene lumps, mixed plastics, or dirt contaminated; we buy them all. Plating removed and mixed plastics separated on a custom basis. Plastic Converters, Townsend, Mass. Tel: Townsend 756.

(Continued on page 260)

(Continued from page 259)

MATERIALS FOR SALE: We have One Million Pounds of Reground and Virgin Molding Materials at low prices. Please request offers for your specific needs. Also—sell us your Surplus and Scrap. Claude P. Bamberger, Inc., Ridgefield Park, N. J. HUbbard 9-5330.

GET THE TOP MONEY FOR PLASTIC SCRAP: Now paying top prices for all thermoplastic scrap. Wanted: polystyrene, cellulose acetate, vinyl, polyethylene, butyrate, acrylic, nylon. All types and forms including rejects and obsolete molding powders. Fast action wherever you are located. WRITE, WIRE TODAY! Reply Box 5504, Modern Plastics.

Molds wanted

MOLDS WANTED: To rent or buy injection molds in good condition for 6 ounce machine. We are interested in novelty, household items or small toy molds. Send samples and information to Atwell Industries, Inc., 706 Vasbinder Drive, Chesterfield, Indiana.

Help wanted

HELP WANTED: Young progressive growth company needs experienced Plastics Product Development and Sales Engineer. Unsurpassed opportunity for right man with training in all aspects of plastic extrusions. Solution and paste resins knowledge and injection molding procedures, desirable, but not necessary. B.S. Chemical Engineering required. Sales training helpful. Must be willing to relocate. Excellent area with ideal year around climate. All replies held confidential. If qualified send full resume to Box 5500, Modern Plastics.

PERSONNEL: Executive—Technical—Sale—Production. Employers and Applicants—whatever your requirements, choose the Leader in Personnel Placement. Cadillac Associates, Inc., Clem Easly—Consultant to Plastics Industry, 29 E. Madison St., Chicago, Ill.—Wabash 2-4800. Call, write or wire—in confidence.

WANTED: Manufacturer of synthetic resins for molding and coating industry requires Technical Sales Representative for Midwest area. Sales experience and chemical or mechanical engineering degree preferred but not essential. Some background in plastics necessary. Income will be commensurate with qualifications. All replies will be treated in strict confidence. Send resume to Box 5506, Modern Plastics.

QUALITY CONTROL ENGINEER: About age 30. B.S. in Chemistry or Chemical Engineering. Two years experience in manufacturing, preferably in quality control. To analyze laboratory data, assist in obtaining operating data for the purpose of establishing standard operating procedures. Excellent salary, employee benefits, and future growth potential. Expanding plastics manufacturing plant in Warren Co., N. J. Reply Box 5508, Modern Plastics.

WANTED: Aggressive sales representatives for custom extrusion firm. We are looking for men with engineering background who can assist customers with extrusion applications and with initiative to build up business on their own. We are well established, located in New York, with large extrusion and extrusion-fabrication facilities, now selling nationally. The following states are open: Alabama, Florida, Georgia, Iowa, Kentucky, Mississippi, Missouri, Carolinas, Tennessee, Texas, Virginias and Wisconsin. Reply Box 5512, Modern Plastics.

PROCESS ENGINEER: About age 35. B.S. Chemical Engineering. Four years experience in process design and development in thermoplastics field. To perform process design, anticipate future operating problems, and provide technical assistance on process studies. Excellent salary, employee benefits, and future growth potential. Expanding plastics manufacturing plant in Warren Co., N.J. Reply Box 5509, Modern Plastics.

WANTED: Phenolic compounding Technician or practical Chemist, experienced with production of molding compounds. Plant vicinity of Newark. State experience, age and salary desired. Reply Box 5507, Modern Plastics.

PROCESS ENGINEER GROUP LEADER: About age 40. M.S. Chemical Engineering. About eight years of practical experience as project leader. To plan and supervise major development programs and projects concerned with new processing methods, new equipment, and new products. Excellent salary, employee benefits, and future growth potential. Expanding plastics manufacturing plant in Warren Co., N.J. Reply Box 5510, Modern Plastics.

PLASTICS SALESMAN: Spencer Chemical Company seeks a man with enthusiasm, drive and a desire for future progress in a plastics sales assignment. Previous sales experience desirable. Technical background also preferable but not necessary. Excellent opportunity for future advancement in a rapidly expanding organization. Please send resume of your experience, education, and salary requirements to: Field Sales Manager, Plastics Division, Spencer Chemical Company, 1004 Baltimore, Kansas City 5, Missouri.

CHEMIST: Key position available with leading coated plastics manufacturer. Laboratory and production experience with organasols, plastisols and vinyl solutions paramount—background including polyesters and epoxies desirable. Employee benefits include profit-sharing and stock ownership opportunities. Location Northern New Jersey. Send resume to—Box 5505, Modern Plastics.

WANTED: Man for sales and supervision of decorative laminate department. (Panelyte) Should have experience in sink top, kitchen cabinet, furniture and allied lines. Top opportunity. All replies held confidential. Reply to Industrial Plywood Co. Inc. 105-15 180th Street, Jamaica 33, N.Y.

MANAGER-MOLDMAKER: Thoroughly familiar with estimating, designing of small molds for plastics and capable of supervising about a 10 man shop, in Philadelphia area. Must have custom molding experience in automatic compression molding, and able to make decisions and take full responsibility of shop. Reply giving age, experience, salary requirements and other qualifications. All replies held confidential. Send resume to Box 5511, Modern Plastics.

EXTRUSION SPECIALISTS: Men with thorough knowledge and experience in set-up of extruded moldings and precision shapes, as well as close tolerance tubing, for permanent position in New York with old, established custom extrusion company. We are looking for men with actual working knowledge, not administrators. Assistance would be given in relocation. Position offers chance for advancement. Reply Box 5513, Modern Plastics.

PLASTICS FOREMAN: Man completely experienced in all phases of injection molding. Excellent opportunity for qualified man to locate in Atlanta, Ga. area. Reply to: Mr. Bernard C. LaBelle, Clearview Container Corp., P.O. Box 9716, Atlanta 19, Ga.

PRODUCTION OR QUALITY CONTROL SUPERVISOR OR ENGINEER: Technical know-how in high pressure plastic laminates. Substantial advancement possibilities for man capable of organizing and setting up department. Experience with paper base phenolics necessary. Should know equipment, controls, materials, sources, etc. A real opportunity with established growth company. Please give details of education, experience, earnings in reply. Reply Box 5514, Modern Plastics.

SUPERVISOR INJECTION MOLDING: Assume complete charge, large injection molding dept. including extrusion and grinding. Must understand plastic mold design, know all makes and types injection molding equipment and have extensive experience running large molding operation. Position demands forceful character, proved administrative ability and complete knowledge of plastic injection molding. Salary commensurate with responsibility involved. Box 513, 1501 Bway, N.Y.

RUBBER CHEMIST WANTED: Position in Extrusion Department. Applicant should have two to three years experience in compounding and processing closed cell rubber. Contact: Karl E. Balliet, Rubatex Division, Bedford, Virginia.

PLASTICS ENGINEER: St. Regis Paper Company has attractive positions available in the Plastics Division for Mechanical/Chemical Engineers with experience in the general field of thermoplastics extrusion and laminations. Specifically, polyethylene pipe extrusion, film extrusion or extrusion lamination. These are responsible positions involving development and production of new products and processes and offer challenging opportunities with excellent growth potential in a dynamic organization. Also, openings for recent graduates with/without eyperience. Submit resume to: Director of Personnel, St. Regis Paper Company, 261 Madison Avenue, New York 16, New York.

PLASTIC ENGINEER: Injection molding company has opening in engineering department for graduate engineer, preferably with several years experience. Will handle estimating, product design, plant engineering. Desire engineer with keen interest in plastic technological advances. Excellent opportunity. Salary commensurate with experience and ability. Send resume to Wolverine Plastics, Inc., Milan, Michigan.

MOLDING SUPERINTENDENT: Medium sized, established and growing, custom and proprietary molder offers excellent opportunity to right man. Must have ten years supervisory background combined with a thorough knowledge of thermosetting materials, production, estimating, engineering, tooling, costs, and quality control. Position offers individual professional recognition in a forward-looking company with a growing business for over 30 years. Reply Box 5515, Modern Plastics.

TECHNICAL SUPERINTENDENT: B.S. Chemical engineer with P.V.C. or related thermo plastics experience in solving plant technical problems. Responsible for laboratory and engineering groups. Opportunity for advancement with established major producer of basic chemicals. Submit personal resumes to Box 5516, Modern Plastics.

GENERAL MANAGER: We are seeking a top notch experienced man completely familiar with the latest developments in injection molding and mold design to assume overall supervision of a growing company specializing in quality work for the packaging field. Engineering Degree preferred, but not essential. Salary excellent. Reply Box 5532, Modern Plastics.

MOLDMAKING SUPERVISOR for injection molding plant, able to design and build molds. Heavy experience with injection molding machines preferred. State background and salary required. Central New Jersey. Reply Box 5533, Modern Plastics.

ASST TO WORK MANAGER, PLASTIC MFR. CO.: Take charge production, injection blow molding, vacuum plating, conveyor assembly. Toys, housewares, etc., 350 employees, New England AAA-1 Company. Have attractive proposition for right man. Reply Box 5534, Modern Plastics.

PLASTIC TOY DEVELOPMENT PRODUCT ENGINEER: Capable taking products from idea through our model shop, Engineering Dept., Machine shop, Art Dept., make ready for production. We can offer a most attractive proposition. Replies confidential. Large New England Company. Write Box 5535, Modern Plastics.

Situations wanted

RESIN CHEMIST: Broad background in polyester, epoxy and urethane resin systems—synthesis, formulation, application and technical service experience. Desire responsible position in technical sales or technical service. Detailed resume on request. Reply Box 5522, Modern Plastics.

PRODUCT, MARKET DEVELOPMENT: 17 years experience in industrial plastics and rubber product, process and market development; 7 years product-sales management plastic pipe. Engineer, age 38; versatile, practical, competent and thorough; now employed. Wish to use this background in progressive, well-financed, small to medium organization. For resume please write Box 5520, Modern Plastics.

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Gentleman, age 35, single. Past positions, product development engineer 2 years; production development engineer 2 years; works manager 8 years, and also some technical sales. Conversant with production planning, method study, stores and stock control. Estimating, budgetary and cost control on batch and flow line production. Covering P.V.C. sheeting, films and spreading; Resin glass low pressure lay ups, high pressure mouldings including pre-mix (Epoxy-Phenolics-Polyester). Foaming; Impregnating; Laminating, Coating and Fabricating. Prime attributes, Organizing, good all round knowledge of processing techniques, with a flair for devising production methods resulting in low unit costs. Free August. Reply Box 5519. Modern Plastics.

ROTOGRAVURE PRINTER: Long, diversified experience with 20" wide machine equipped for printing, gravure coating, laminating, roller polishing on vinyl acetate, fiberglass, for ribbons, lamp shades, dress belts and narrow fabrics; seeks job or proposition. Reply Box 5517, Modern Plastics.

CHEMICAL ENG.: Specialized in plastics 14 years, interested in Executive Job in South America. Actually engaged with raw material manufacturer in Brazil. Exp: Plant manager, executive on multiplant level, development, tech. sales, sales. Close contact with market. Thermoplastics, cellophane, raw materials and converted products. Natur. Brazilian. 44 E. Lovik, 3715 Parkview Ave., Pittsburgh 13, Pa.

POSITION WANTED: Capable, Aggressive—presently chemist with large calendering company. Thorough knowledge of compounding, color-matching, and reprocessing of all P.V.C. materials. 10 years experience in all types vinyl formulating, compounding, and problems of extruders, mills, and bambury. Previous background includes profile extrusion and electrical molding compound. Desire a responsible position with manufacturer. Californian location desired. Complete resume on request. Age 31. Reply Box 5518, Modern Plastics.

MANUFACTURER'S REPRESENTATIVE: Can sell stock plastic parts such as knobs, handles, clips, coil forms, gears, pulleys, brush caps and other industrial plastic parts from stock molds and dies. Presently handle custom molded plastics only to industrial accounts Chicago, N. Illinois, and S. Wisconsin area. Reply Box 5521, Modern Plastics.

TOOL MAKER: Experienced in building of Vacuum Forming Machinery: including sheet line and special machines. 6 years experience. Good idea man with design ability. Capable supervisor, with ability and knowledge in all phases to build and put into production this type of machinery. Reply Box 5523, Modern Plastics.

Miscellaneous

MANUFACTURING AGENT: Represent America's most progressive custom plastic injection molder. Facilities include deep draw capacity from 4 oz. to 60 oz. Exclusive arrangements. Write in confidence. Reply Box 5524, Modern Plastics.

WANTED TO BUY: Small injection and compression molding plant, including machines of at least 22 oz. capacity. Reply Box 5525, Modern Plastics.

FOR SALE: Fiberglass boat manufacturing plant for sale. One of the oldest successful operations in the United States. Located in South Florida. Matched mold process. Producer outboard runabouts and sailboats. Brilliant future. Owner must sell. Price-$140,000. Reply Box 5527, Modern Plastics.

MAKE EUROPE YOUR MARKET! Important German Manufacturer of thermosetting raw materials wants to enlarge sales program by Sole Distribution of New, Special Thermoplastic Raw-Materials in the Federal Republic of Germany, if possible in all six countries of the European Common Market. Reply Box 5531, Modern Plastics.

WANTED TO BUY: Small to medium size plastic operation located in the northeast, preferably New England. Must show earnings record. Reply Box 5526, Modern Plastics.

U.S. PATENT: 17 years on 36mm Colorslide with outstanding features and proven sales records available for wide awake Molder. License arrangement. Reply Box 5528, Modern Plastics.

WANTED TO BUY: Whole or half Injection Molding Plant now in operation. Tool room facilities and New York metropolitan area preferred. Combined business should show better profit. With reply, list size of machines and plant footage. Reply Box 5529, Modern Plastics.

Modern organized plastics manufacturer in the Federal Republic of Germany is looking for new extruded profiles made of plastic (polyvinylchloride) for manufacture on a license (royalty), basis—offers to be sent to Box No. 5530, Modern Plastics.

RATES FOR CLASSIFIED ADVERTISING

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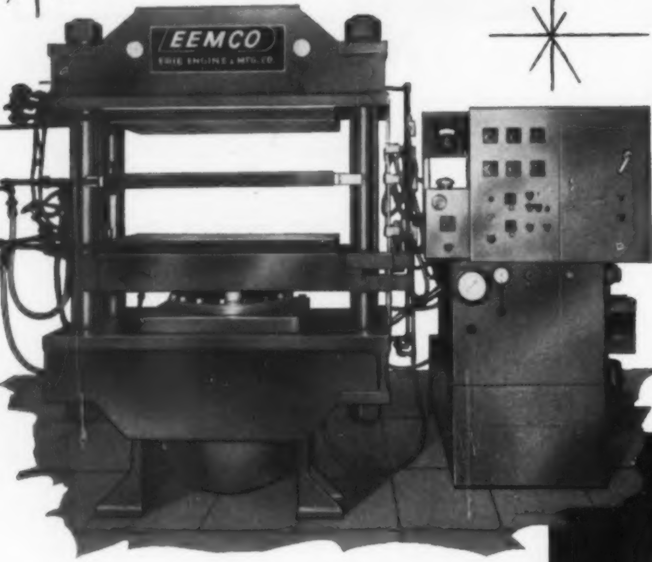

Illustrated Compression Molding Press with 314 ton capacity. Platen sizes 45″ x 30″—2-10″ openings, with semi-automatic controls. EEMCO builds a complete line of Presses for Laminating, Transfer Molding and Reinforced Plastics.

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SPRITS	20 Oz.	.05	$1.00	12
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NOW ORDER SPRITS

. . . has everything its imitators have . . . yet it's ½ the price!

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World's best formula: *made of DuPont Freons and Dow-Corning Silicones. NON-TOXIC, NON-INFLAMMABLE. Reaches all cavities: improves surface finish.*

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SPRITS 146 Merrick Road, Lynbrook, N. Y.
Send SPRITS as follows:
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FOREMOST new H.D. series!

This new line of heavy-duty grinders has received tremendous acceptance quickly, due to its rugged construction and ease in cleaning. They are currently available from stock in the following models:

Model	HP	No. of Rotor Blades	Throat Opening
HD-1	3	2	8½″ x 10″
HD-1A	5	4	8½″ x 10″
HD-2	5	2	10″ x 14″
HD-2A	7½	4	10″ x 14″

The 4-bladed rotor machines should be used for heavier duty applications, such as small purgings, pipe fittings, and nylon gears. Manufactured by Foremost Machine Builders, Inc., Livingston, New Jersey, and sold by:

The Rainville Company

657 Franklin Avenue, Garden City, L. I., N. Y.

DISTRICT OFFICES: Quinebaug, Connecticut; Abington, Pennsylvania; Franklin, Pennsylvania; Detroit, Michigan; Dayton, Ohio; Evansville, Indiana; St. Louis, Missouri; Chicago, Illinois; Minneapolis, Minnesota; Dallas, Texas; Alhambra, California; Toronto, Canada (Husky Manufacturing & Tool Works, Limited).

INDEX OF ADVERTISERS

Distribution of this issue: 33,550 **May 1959**

(Continued on page 268)

The Molder's Molding Machine....... The New **NATCO 400** gives you.

- **28 oz. SHOT** — single feed!
- **PARTS UP TO 15″ DEEP** — Fast!
- **DEPENDABILITY** because it's shockless!

Shot capacity	28 oz.
Clamp pressure (max.)	425 Tons
Platen size	38″ x 38″
Daylight (max.)	50″
Plasticizing capacity	165 lbs. per hr.
Stroke (max.)	26″
Horsepower	47½

For over fifty years, designers and builders of automatic production machinery.

Versatile Natco Injection Molding Machines are available in stock sizes with shot capacities ranging from 12 to 85 oz. All are compact, self-contained units; all feature Natco's exclusive "closed-circuit" hydraulic system. Call or write today.

Ask for Bulletin 4001.

NATCO PLASTICS MACHINERY DIVISION

National Automatic Tool Co., Inc.
RICHMOND, INDIANA

Representatives in principal cities.

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EXCLUSIVE:

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- PATENTED SWING DOOR
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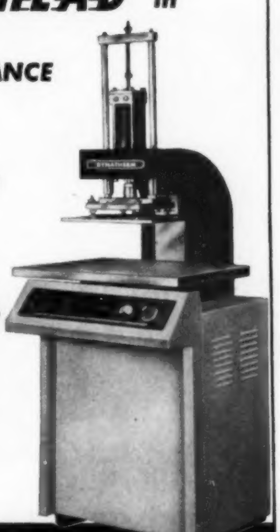
- CENTRAL CONTROL PANEL



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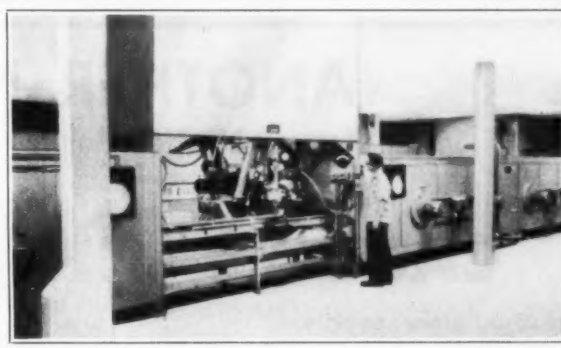

Continuous Molding Line. Molds move from l. to r.: from Pre-Heat Oven to Pouring Station (which includes traversing unit, mixer) to Pre-Cure Oven to Stripping Station.

URETHANE FOAM PRODUCTION LINES

Leon designs and manufactures pilot and full production urethane foam equipment—from individual components to complete plant installations—for producing both molded products and slab stock.

- Traversing Units
- Processing Ovens
- Single & Multi-squeeze Roll Units
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(Continued from page 266)

MODERN PLASTICS

A BRESKIN PUBLICATION

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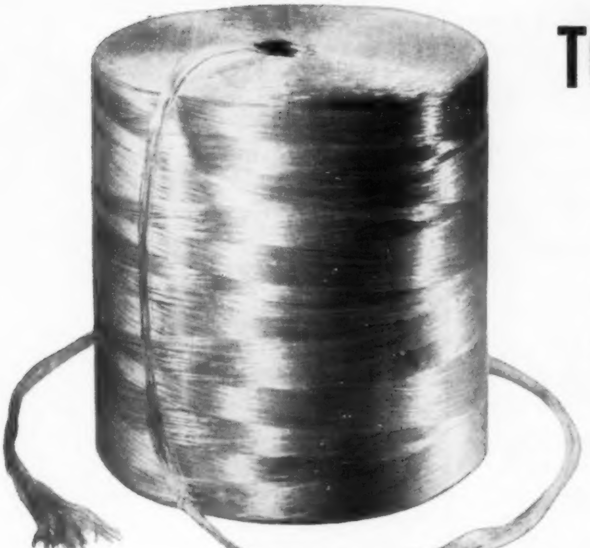

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technical assistance available

You can arrange to have free trials made on your own preforming or spraying operations to show you how PPG Roving can help you produce better end products and save you money. Write or call your nearest PPG Sales Office, or write *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.*

Sales Offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, Minneapolis, New York, Philadelphia, Pittsburgh and St. Louis

FIBER GLASS **PITTSBURGH PLATE GLASS COMPANY**

EDITORIAL

Labor wants to know about plastics

This year the editors of MODERN PLASTICS will answer more than 25,000 Readers' Service inquiries. That is an average of 100 a day by telephone, by wire, or cable, by letter, or by visit to our offices. People in 67 countries made inquiries of us last year; at least that many will be heard from in 1959.

No analysis has ever been made of the proportion of subscribers to non-subscribers in the total. We don't even care.

What do we get from it, aside from the self-satisfaction of altruistic effort?

We get a fantastic cross-section of interest in plastics—not reader interest, but people interest—from all over the world. And sometimes the implications for the plastics industries in this range of interests is downright thrilling.

An example: A big phase of plastics' future is recognized to be in the construction field; a major stymie is craft inertia and ignorance. Within one recent week we received letters from two labor union officials in the construction industry asking how to organize classes in plastics under adult education auspices in local schools, and how to get instructors and printed material so that their union members might get to know plastics and how to work with them in the building field.

Considering that both societies in the plastics industries, the various chemical associations, building product manufacturers' groups and architectural bodies are all concerned about craft ignorance of plastics, these two letters from organized labor present an opportunity—yes, a challenge.

Where there's smoke, there's fire. If two union officials at local level take pen in hand to make inquiry, hundreds must be thinking about craft problems with plastics.

Here is a chance for our Societies to get down to cases with labor unions at the national level and disseminate information through them to the locals, working through adult education facilities in the schools.

In a year or two this activity would go a long way in overcoming much of organized labor's opposition to the introduction of plastics to their trades.

Hiram McCann

Modern Plastics Executive and Editorial Offices: 575 Madison Avenue, New York 22, N.Y.